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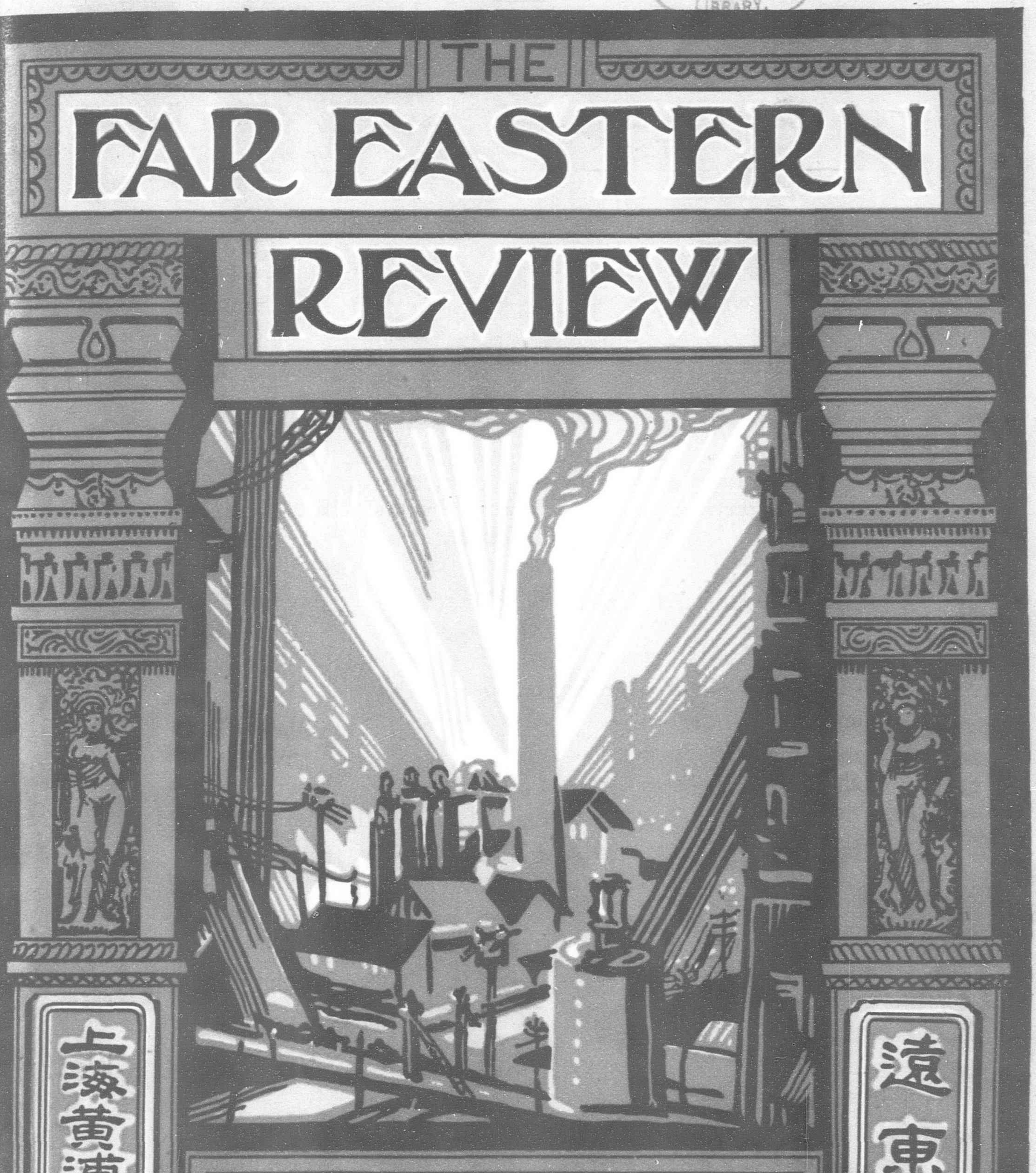

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THE CRISIS IN CHINA

THE FORCES IN NORTH CHINA

JAPAN'S FUNDAMENTAL TRADE PROBLEM

Vol. XXXIII JULY, 1937 No. 7

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ENGINEERING FINANCE COMMERCE

VOL. XXXIII SHANGHAI, JULY, 1937 No. 7

The Crisis in China

Tokyo Government Opposes Warfare, But Nation is Ready for any Sacrifice

By FRANK HEDGES

(The author of the following article, taken from the North-China Daily News, is one of the outstanding foreign correspondents in Japan, and is Staff Correspondent for the North American Newspaper Alliance, London Daily Telegraph and The Washington Post).

WHETHER Japanese and Chinese troops will be engaged in large-scale fighting round the walls of Peiping by the time this letter is published cannot be accurately foreseen, of course, but every indication available in Tokyo is that this will have taken place. It would seem, from this point of observation, that major propelling forces have been unintentionally and even accidentally set in motion which nothing can now stop, however much either Tokyo or Nanking or the two together may desire to arrest them. Your correspondent hopes that he is utterly wrong in this analysis of the situation and that some peaceful settlement may yet be achieved, but honesty compels the admission that no way to such a settlement is perceptible.

What a major war would mean to both China and Japan is so apparent that one shrinks in horror from the prospect. If it should be fought to a conclusive decision, it would really make no great difference which side was the technical victor. This Empire would be so exhausted economically that it would be set back at least a generation, whereas all of the elaborate and so largely successful economic, political and other machinery self-created by China under its Kuomintang Administration would be sorely crippled if not entirely wrecked. Neither Japan nor China has anything to gain by trying her strength on the field of battle at this time; both have much to lose.

Japan, at least the Government and the War Office, are fully conscious of this truth and would do much—will do much—to prevent the outbreak of war. It is believed in Tokyo that the same views are held by Gen. Chiang Kai-shek and the majority of the Government in Nanking. But it is also fully realized that events have moved so rapidly, that such bitterness and inflamed passions have been roused since the night of July 7, that it is probably beyond the power of either Government to divert its peoples and its armies from major fighting in an unofficial war, albeit that war may well last only a few months, as by that time sufficient blood may have been let to satisfy the younger element in both nations and the general public.

The situation has progressed far beyond such a comparatively minor question as to "who started it," specially since it is quite evident that the troops of both Japan and China thought they had sufficient provocation. The most reasonable and logical explanation that I have seen was that of the Peiping correspondent of the *North-China Daily News* written under date of July 10, as being due to "the jumpiness of the 29th Army and the tactlessness of the Japanese."

Admirable Restraint

At the risk of rousing resentment among many readers, it must in honesty be recorded that Japan and the Japanese people have shown an admirable and unexpected self-restraint up to the moment. Certainly it is a self-restraint such as has not been in evidence for many years past when conflict of any type arose with China. If the present situation had come into existence a few years ago, the Japanese Army would long ago have been at the throat of the Chinese forces. That it is not so to-day is interesting, significant and capable of explanation and analysis.

There are several motives entering into Japan's reluctance to take the field of battle now that what seems, from the Japanese viewpoint, a golden opportunity is offered, and the chief of these is that Japan desires no war of any sort, official or unofficial, with China or with any other Power, at the present time. If necessary, Japan will fight, and how good an accounting it will give of itself can best be surmised by a glance at previous wars in which this Empire has been engaged. But the outstanding fact is that Japan does not want to go to war if it can be honorably avoided—but only honorably avoided—and if public opinion can be controlled.

I emphasized before the first hostilities near Peiping, that the pivotal principle round which all Japanese policy was designed to revolve for some years to come was that of placing the nation on a "semi-wartime basis." This is capable of no other interpretation than that the Government and the defence services do not consider the nation to be on such a basis to-day. Else why this five-year drive that will strain every nerve to achieve such a status?

Menace of Soviet Russia

Japan feels that it is quite capable of meeting and drastically defeating China in battle, but there are other impelling reasons why this country wishes to perfect its armaments, its economic and political structure before taking the field against any Power. Not the least of these is the ever-present menace of Soviet Russia as conceived by Japan. Still another is the feeling existing in some circles here, principally among Army men and those of the extreme Right wing school of thought, that modern Japan has strayed from the ethics and principles upon which the Empire was founded, and that the present generation must be brought back thereto.

Additional, but lesser reasons may be advanced, but the central fact, that Japan prefers not to fight at this time and is willing to go to some lengths to avoid so doing, remains unchallengeable. If this were not the case, an undeclared Sino-Japanese war would have been under way at the first violation of the truce concluded on July 11, between the North China Garrison and the 29th Route Army.

The wiser heads in Japan, those who ordinarily direct national policy, feel that the nation is somewhat over-expanded at the moment and that a period of peace and quiet, both internal and abroad, is essential for consolidation and upbuilding. During this period Japan is no more anxious to engage in aggressive action than was the Soviet Union when it embarked upon its first five-year plan.

Want World's Good Opinion

It may fall on sceptical ears, but an additional reason why Japan prefers now to pursue a peaceful path is in order to regain the good opinion of the world, which was so largely sacrificed by

the Manchurian campaign and the Shanghai Incident. When Mr. Yosuke Matsuoka as the nation's spokesman walked out of the League of Nations in Geneva with a chip on his shoulder, the idea prevailed in Japan that it had no particular need of Europe and the Americas, that Japan could " go it alone " by concentrating on an East Asia policy and making itself the unchallenged master-dictator of this quarter of the globe.

The few years which have intervened have brought disillusionment with them. The evidence of this fact is so strong as to be incontrovertible. Not only have Japanese horns been drawn in to a considerable degree as regards Soviet Russia, and the policy toward China modified, but the Anti-Comintern Agreement with Berlin was motivated in part to gain a friend in the West. At the very moment of the most recent Sino-Japanese trouble Ambassador Shigeru Yoshida was seeking, in London, to bring about a rapprochement with the British Empire.

With the cessation of the provocative notes of protest from the former American Secretary of State, Mr. Henry L. Stimson, American-Japanese relations have grown so steadily better that they were almost back to the desirable state of 1923. Much of this hardly achieved progress toward improved international relationships would, of necessity, be sacrificed in the event of a major armed clash with China, and this Japan fully realizes and so would avoid if possible.

Awake to the Situation

For some time past not only the Tokyo Government but the Tokyo War Office has been awake to the realities of the Far Eastern situation and to Japan's unquestioned needs. That blind faith in its own ability to achieve the impossible no longer exists in this country, although it lingers on in some sections of the defence services and the public at large. There is a full consciousness of the military might of Soviet Russia and particularly of the Russian war machine in the Far East.

There is almost equally great realization of the remarkable progress that China has made toward political and economic unification, toward preparing itself for armed conflict. There is, most important of all, the awakening of the higher officers of the Japanese Army to the fact that such a thing as economics exist and that unless both nation and Army be on a sound economic basis the achievement of Japanese ambition becomes impossible.

Given all these factors—and they are the factors actually to be found—it becomes understandable why Japan would vastly prefer to settle the trouble with China without resorting to arms. It is granted by the Tokyo Government, I believe, that China also would vastly prefer not to wage war.

Public Opinion Inflamed

As day has succeeded day the situation has grown more and more tense, public opinion in both countries has become more and more inflamed, and if there is any way of honorably drawing back from the brink of the abyss that now looms it cannot be seen by the eye of the layman and neutral observer. The forces set in motion by those first few rifle shots have reached a point where it seems inevitable that blood, and much blood at that, will have to flow ere sanity can be restored. Both sides, in so far as public and military opinion go, have worked themselves up into a frenzy that can be exorcised only by this old-fashioned method of each killing thousands of the other's men.

Your correspondent devoutly hopes that he is entirely wrong and will be only too glad to join the ranks of the false prophets if but the opportunity is afforded him, but watching and sensing the pulse of opinion here, both official and mass, he can record no other prophesy.

Japan is convinced that (unofficial) war is inevitable. That conviction extends from the most highly placed Japanese to the man in the street. There are, of course, a few exceptions, but they are so few as to be negligible. The only place where optimism can be found to-day is, curiously enough, in the diplomatic corps, but even there it is not unanimous. How such optimism was achieved by those supposed to be *en rapport* with all things Japanese is unfathomable, nor is it possible to detect upon what it is based.

No intelligent Japanese to whom I have talked but is seriously concerned and feels that major conflict is now become unavoidable, but feels that the Empire faces its gravest crisis since 1904 and the outbreak of the Russo-Japanese War. No newsboy, house servant, hotel bellboy, petty merchant or other of the many facets that make up the composite " man in the street " but voices the same conclusion, although he has reached it more by a process of intuition and feeling rather than of informed reasoning. It is nonetheless strong and powerful for that.

The manner in which the nation has moved as a unit, has been welded into a single mind, since the Sunday morning of July 11, is amazingly remarkable. It was on that Sunday morning that the North China situation for the first time assumed a really serious aspect in the eyes of Japan. All day long the bells of newsboys selling " extras " were to be heard and the general public became thoroughly aroused. The Cabinet met in urgent session, and the Prince-Premier departed immediately thereafter for the seaside palace at Hayama where His Majesty was staying only to hasten back to Tokyo himself the next day.

Major Elements in Conference

During the few days that immediately followed, the Government called into conference representatives of every major element that goes to make up the nation. The parties without exception pledged an unwavering support to the Government's policy in North China whatever it might be. So did the House of Peers, matching its loyalty with that of the Laborite Shakhai Taishuto and of the 50,000 men and women in the prisons of the Empire. Bankers, industrialists, merchants and all other business men likewise expressed their willingness to sacrifice their last sen in the event that became necessary. Educators and prefectural governors, students and farmers and day laborers were and still most distinctly are as one in this respect, and above all the women of the nation, those who are always called upon to make the most heart-rending of all sacrifices when war comes, stand in solid and unwavering support of the Government and whatever it deems wisest to do in North China.

The Japanese are a strongly integrated nation and people at all times. From the national standpoint their psychology is still largely a tribal psychology surviving on into this modern age. An injury to one member of the tribe is an injury to all others to be avenged regardless of the cost, and always, ever and above, is the Great Tribal Chieftain. Seldom has this psychology been given the opportunity to function so dramatically as during these trying days that were ushered in by a few rifle shots at night on the plains of Hopei.

There is simply the one outstanding fact to record: Japan prefers not to fight but is ready to do so unless some at present veiled way out of the impasse be found.

China's Postal and other Communications Services

A concise and authoritative account dealing with the historical development and functions of the Ministry of Communications, Post Office, Postal Remittances & Savings Banks, Marine and Navigation Administrations, Telegraph, Telephone and Wireless Services, and the Growth of Commercial Aviation in China, down to the present, is the content of a book written by Dr. Chu Chia-hua, Chairman of Chekiang Province and former Minister of Communications (1932-35).

Contrary to expectations this book does not, however, only review the work of the Ministry during the three years the author was at the head of the Chiaotungpu between 1932 and 1935. A survey is given of the beginnings of the various branches of communications and, offering a short historical perspective of each branch, the author pays due regard to the ground work that was laid by earlier government organs and administrators, both under the pre-revolutionary and post-revolutionary regimes.

Not before February, 1930, did the Ministry of Communications take over exclusive control of the administration, direction, and supervision of the national telegraph service (including telephones), the national postal service (transportation of mails, postal savings banks, parcel post system, postal money orders), the activities of navigation companies, private and Government, and such matters as harbor works, shipbuilding, airmail service, radio communica-

(Continued on page 261)

The Forces in North China

(By a Military Observer in The North-China Daily News)

Two armies are assembling in China's Tom Tiddler's ground, Hopei province, where, since 1933, the Chinese have claimed authority and the Japanese have virtually exercised it. In the immediate neighborhood of Tientsin and Peiping, where the present tension is greatest, there are between sixty and seventy thousand Chinese troops. Of these, only about twenty thousand have, so far, shown themselves to be anti-Japanese. These men belong to the 37th Division, attached to the 29th Army. Between them and Tientsin are men of the 38th Division, under the command of General Chang Tzu-chung the mayor of Tientsin, who have, except for one brief exception of a skirmish at Lanfeng on the Peiping-Tientsin Railway, so far proved indifferent to the dispute.

Two divisions of Central Government troops have already arrived at Paotingfu, the capital of Hopei province, according to the latest reliable reports. They are the vanguard of a Central Government advance, which shows few signs of being pushed any further. There are at least three more Chinese divisions along the Peiping-Hankow Railway, but they are still in Honan, and the rate of their advance gives no justification to the Japanese fears, freely expressed by their military commanders, that they can be of any influence on the situation for some weeks to come. That is to say, if their advance is continued.

Japanese Concentration

On the other hand, there are about twenty thousand Japanese troops at present in North China, mostly concentrated around Peiping and Tientsin, and along the Peiping-Mukden Railway, in the demilitarized zone. Six thousand of these troops are from the ordinary Japanese North China garrison, they hold Tientsin, the two railway stations in that city, and the railway bridge from Tientsin towards Peiping. There is a battalion of Japanese at Fengtai, which has recently been reinforced by troops sent from Manchuria through Shanhaikwan. Other Japanese troops are distributed in the neighborhood of Tientsin and along the Peiping-Mukden Railway. Several thousand have come into Hopei from Jehol, via Kupeikow, but it is expected that these will be withdrawn to rejoin the Kwantung Army in Manchuria as soon as reinforcements have arrived from Japan proper. For, in the Japanese view, Manchoukuo is sparsely enough garrisoned without being drained of troops for a speculative venture in North China.

To support these troops, at least two divisions of Japanese are on their way from Japan to Tangku. Two, possibly three, other divisions have been warned for service, and are being made ready to join the divisions in North China should the emergency arise.

The peace strength of a Japanese division is about ten thousand men ; the war-time strength approximately double. It is, therefore, probable that the divisions being sent to North China and under provisional orders to go there, number between seventeen and eighteen thousand men each. If nothing occurs to make necessary the dispatch of the extra divisions from Japan, it is probable that, before ten days are out, the Japanese will have in North China approximately fifty-five thousand men, with the usual army equipment of guns, tanks, lorries, and the necessary adjuncts usually associated with Army troops.

Heavy Expenditure

At a minimum calculation, the maintenance of a force of this size on a war basis in North China will cost the Japanese government Y.35 per month per man, and about double that per officer. Estimated at the lower figure, Japan's expeditionary force cannot cost less than Y.1,925,000 a month. This estimate does not take into account the cost of transportation, ammunition, billeting, and the re-equipment of reservists who have been called up to put the divisions on to a war basis. Nor does it reckon the cost to the Japanese government of the men who were due to have been returned to civilian life this month and who have been kept on in the service on account of the northern crisis. As can be seen, the total cost will be enormous, for results which are, to say the least, of doubtful benefit.

The same cannot be said of the Chinese. The strength of a Chinese division is not so easily estimated, owing to the irregular formations which are still adopted, in spite of the Central Government's best efforts to put the army on a modern footing. The Chinese can, however, move along Chinese government railways, and, owing to the recent requisitioning law, need not cost much to feed. The divisions have not been brought up to a war basis, having been kept at full strength all the time. And the additional expenditure is almost nothing. In this the Chinese have a financial advantage. That is about all, according to competent military observers, since the Japanese are far better trained and equipped, better fed, and better led, and in a battle of man to man should prove easily superior.

Extraordinary Indifference

Several points have been noted by observers in Shanghai in connection with the northern outbreaks. The first is the extraordinary indifference of the 38th Chinese Division to the plight of their fellow division in the 29th Army, the 37th, under General Feng Chih-an, the chairman of the Hopei provincial government. The 38th Division, with the exception of one minor skirmish cited above, have been ostentatiously neutral. The question is asked : What influence is at work with those Chinese generals ? Some observers have definite views on this matter, since some vital points along the railway between Tientsin and Peiping—vital, that is to say, for communications by the Japanese with their forces at Fengtai and Lukouchiao—have been left to the guardianship of Chinese police and members of the Peace Preservation Corps. If the Japanese had any reason to fear that these points were vulnerable to their enemies, surely they would have taken the precaution to guard them themselves.

Another point is the doubtful attitude in the event of a war between China and Japan in the north, of the provinces of Shantung and Shansi. It is curious to note that the Nanking Government, though ostensibly anxious to rush as many troops to the north in as short a time as possible, has not made use of the Tientsin-Pukow Railway. This railway runs through Shantung, and the inference taken, perhaps incorrectly, is that General Han Fu-chu has not yet made up his mind whether the time has come for Shantung to be embroiled with the Japanese or not. Similarly the attitude of General Yen Hsi-shan has not been so definite as to encourage the belief that he will wholeheartedly throw in his lot with the Central Government in the event of widespread hostilities.

The Japanese profess to be alarmed over the Central Government's attitude towards the Communists, at present peacefully in possession of a portion of northern Shensi. They prophesy an early rapprochement between the Reds and the Government, and independent observers consider that this is by no means unlikely, if the Central Government is forced by outside pressure to tolerate political opponents for the sake of national unity, and to meet a common enemy. Only extreme outside pressure could bring this about, it is believed, and if it happens, there may follow a re-orientation of China's foreign relationships for which only those who have brought the pressure to bear can be held responsible.

Railway Orders

Buying for the Canton-Hankow Railway continues upon a large scale, and the Chinese Government Purchasing Commission has recently placed orders with various British firms, including Messrs. J. Stone & Co., Ltd., London ; the Butler Machine Tool Co., Ltd., Halifax ; Messrs. Whitelegg & Rogers, London ; Messrs. Howell & Co., Ltd., Sheffield ; Messrs. G. D. Peters & Co., Ltd., Slough ; Messrs. J. W. Carr & Co., Ltd., London and the Cravens Railway Carriage and Wagon Co., Ltd., Darnall.

Murex Welding Processes, Ltd., are to supply welding material and equipment for the Tientsin-Pukow Railway.

Japan's Fundamental Trade Problem

By KIYOSUE INUI, LL.D.

(The author of the following paper, which was submitted to the International Studies Conference, formerly was Lecturer at the University of Southern California and at the Tokyo University of Commerce).

THE writers on the question of Japanese population a few years ago mostly approached the question from the viewpoint of food supply to the nation. Though that question still taxes the minds of many, especially as regards the ability of her scientists and experts to keep up the increase in productivity of her small arable area with the increase of her population, the more impending and fundamental one is the rapidly rising standard of living of the increasing number of the people, which fact, has come to stare at the face of the nation more blatantly. The industrialization of the nation and expansion of her foreign trade are generally held as the remedies of her vital problem. She is, of necessity, interested in free access to raw materials, of which she is sorely in need, and freedom of trade with the accompanying removal of trade barriers.

However, it is not here proposed to make any exhaustive study of the extent of the lack of raw materials or accessibility to them. Neither do we propose to study the field in which to dispose of the products. This brief survey is merely intended to examine the relationships between these two stages of economic activity, namely, access to raw materials and distribution of products, or the indivisibility of the two units of the same problem. To that end we shall trace the sources of raw materials and widely-scattered markets for a couple of branches of textile industries which are of vital importance to Japan, and the rôle that she is expected to play.

The consideration of the subject is based on peace time as its background, for there is no limit, when we take into account an emergency, as too many contingencies are possible to allow any reasonable discussion or calculation in a small paper such as this. For the writer understands that we are interested in the inauguration of a regime of permanent and gradual peaceful change or evolution which automatically removes the possibilities for emergencies.

The writer resorted mostly to the figures of the last ten years. Though they are not normal years by any means, they were certainly not what may be termed an abnormal period so far as Japan is concerned ; at least it would be too long to be so named.

Although we have selected cotton and wool merely as two representative types, we are not holding them out as applicable to all cases. Furthermore, inasmuch as many woven goods are of mixed materials, proportions used are not easily ascertainable. We hope, however, they may indicate tendencies which we are attempting to indicate.

Figures for the amount of production include only those enterprises employing, or capable of employing, five or more workers. The word "country" appearing now and then merely gives geographical designation and not an independent political unit.

Yen is used in calculation, inasmuch as most of the easily available statistics were based on that unit, though it must be remembered that in 1933, it became devaluated by less than half, and at present, to about one-third the original gold basis.

The writer owes it to the readers to explain that these charts and tables, with the exception of those originating in government sources, are introduced merely as illustrative, inasmuch as he was unable to verify their accuracy—for the reason stated above.

Importance of Raw Materials to Japan

That raw materials are essential to any industrial nation goes without saying. But their necessity to a nation such as Japan is appalling, to say the least.

A. Importance of Industrial Raw Materials to Japan

To a nation like Japan, salvation lies in its ability or opportunity to sell its relatively cheap, capable and willing labor. Facts speak louder than words when we follow up the story of raw cotton, for 99.9 per cent of it is imported from abroad, and on it, Japan has built up her greatest export industry.

What is not of assurance to Japan is the fact that she lacks practically all, or a large per cent of her raw materials, in what are known as essential, heavy industries.

The following table shows the proportions of raw materials imported by her during the years 1933 to 1934, as compared with those of domestic production.

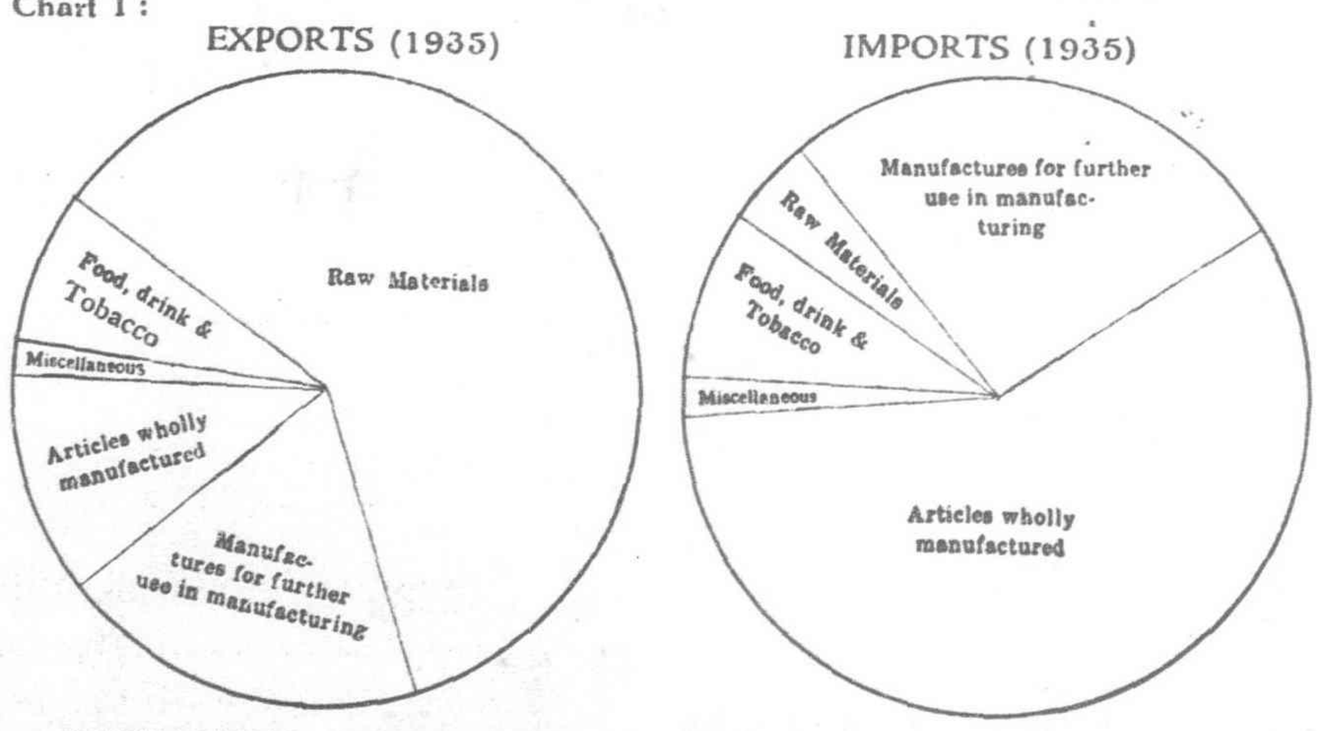
Dependence of Japan on Foreign Raw Materials

Table 1

	(A) Amount imported in units of Y.1,000		(B) Domestic production in units of Y.1,000		Percentage of (A) to (A)+(B)	
	1933	*1934*	*1933*	*1934*	*1933*	*1934*
Raw cotton ..	604,848	731,425	186	129	99.97	99.98
Wool	164,192	186,544	—	—	100.00	100.00
Other raw vegetable textile materials ..	23,137	27,462	37,752	4,310	86.05	86.43
Rubber	35,784	65,986	3	3	100.00	100.00
Oil-extracting materials	23,293	25,257	18,651	13,874	63.3	64.54
Pulp	27,066	44,236	7,452	17,524	78.41	71.63
Crude and heavy oil	68,347	82,483	8,959	9,430	88.41	99.74
Rock phosphate .	15,374	16,677	—	—	100.00	100.00
Coal	36,657	47,193	195,467	245,555	15.79	16.12
Pig iron ..	25,252	26,528	8,633	50,422	74.52	58.17
Other iron materials	111,388	145,350	309,150	694,159	26.49	20.94
Other minerals ..	96,994	135,532	185,010	160,699	34.39	45.75
Total ..	1,232,333	1,534,605	737,313	1,196,105	62.52	56.20

Another source gives a survey of more items showing the extent to which Japan is dependent upon foreign sources for her raw materials. " Out of the sixty-five items selected for the purpose, only nine are produced in Japan in quantities more than sufficient for domestic use in her industries ; in other words, only nine exceed the 100 per cent self-sufficiency ratio, leaving a margin for export. Seventeen barely reach the self-sufficiency ratio, that is 100 per cent. Eight items marked 50-90 per cent show a fairly good condition of supply. In short, the number of raw materials of which the domestic supply is above the 50 per cent self-sufficiency rate is only 34, about half of the items in the list. The remaining 31 items showing less than the 50 per cent self-sufficiency rate have to be imported. In some cases there is no domestic supply

Chart 1 : IMPORTS AND EXPORTS OF 1935 IN CHART*



* FINANCIAL AND ECONOMIC ANNUAL OF JAPAN 1936. The Department of Finance.

whatever, Japan being entirely dependent upon imports. Unfortunately there are seventeen such items at present.*

**The Industries of Japan*, Number 1. General Treatise, pp. 63-64. Tokyo Chamber of Commerce and Industry, 1937.

Ratio	*Classification*	*Articles*
A (more than sufficient) above 100%	Inorganic material	Silver, Sulphur, Arsenic
	Organic material	Raw Silk, Fish-oil, Camphor, Menthol, Vegetable Oil, Rayon.
B (Almost self-sufficent) 90-100%	Inorganic material	Pig Iron Amalgamated, Steel and Steel Material, Bismuth, Graphite, Gypsum, Clay and Koaline, Silica Sand, Fluor Spar and Pagodite, Alumstone, Nitrogen (fixed), Iron Sulphate.
C (Fairly good in sufficiency) 50-90%	Inorganic	Pig iron, Copper, Coal, Machine-oil, Asphalt.
	Organic	Pulp for Paper Manuf'g. Paraphine, Animal Skin.
D (Meagre supply) 10-50%	Inorganic	Iron ore, Scrap iron, Lead, Zink, Malybdenum, Table Salt.
	Organic	Tin, Manganese, Tungsten, Animal hair, Animal fat, Grease, Shells, Hemp, Oilseeds.
E (Extremely poor supply) 0-10%	Inorganic	Nickel, Antimony, Mercury, Platinum, Alminium, Mica, Asphalt, Magnesite, Phosphate, Potash salt, Saltpetre.
	Organic	Wool, Rayon pulp, Shellak, Raison, Tannin, Cotton, Petroleum.

N.B.—General Survey, 1933. To ensure exactness, some important items repeated in different classes.

Table 2 is an eloquent testimony of the rapid industrialization of the country within the past ten years. It will be noted that there is a decided increase in wholly manufactured goods and a proportionately remarkable reduction in the exports of raw material and partly manufactured goods, whereas there has been a considerable increase of raw materials and a decrease of wholly manufactured goods in the import columns.

Amount and Percentage of Exports and Imports in Stages of Production*

Table 2

Exports

Year	*Total*	*Food, Drink and Tobacco In natural state*	*Partly or wholly prepared*	*Raw Materials*	*Partly Manf'd. Goods*	*Wholly Manf'd. Goods*	*Misc.*
1926 ..	2,044,728	49,170	98,125	140,250	881,863	852,119	23,201
1927 ..	1,992,317	54,165	91,397	137,324	852,183	831,236	26,012
1928 ..	1,971,955	47,069	116,151	90,249	861,188	812,949	44,349
1929 ..	2,148,619	48,155	111,963	90,170	912,614	937,307	48,410
1930 ..	1,469,852	42,061	86,760	65,270	546,429	691,190	38,133
1931 ..	1,146,981	37,664	64,634	45,698	438,650	532,930	27,406
1932 ..	1,409,992	26,717	77,561	51,066	486,199	700,509	67,886
1933 ..	1,861,026	30,320	127,668	73,765	538,793	1,031,576	58,924
1934 ..	2,171,925	48,316	123,615	95,739	498,129	1,344,412	60,214
1935 ..	2,099,013	31,801	141,309	110,463	672,413	1,451,330	67,757

*55th Annual Statistical Returns of the Japanese Empire : Government Census Bureau, p. 179.

Imports

Year	*Total*	*Food, Drink and Tobacco In natural state*	*Partly or wholly prepared*	*Raw Materials*	*Partly Manf'd. Goods*	*Wholly Manf'd. Goods*	*Misc.*
1926 ..	2,377,484	243,221	107,059	1,341,918	357,181	314,990	13,115
1927 ..	2,179,154	222,727	100,813	1,201,982	348,160	290,475	14,996
1928 ..	2,196,315	208,894	89,649	1,165,198	382,930	332,990	16,653
1929 ..	2,216,238	214,362	56,362	1,223,917	355,600	346,384	19,183
1930 ..	1,546,071	147,578	60,718	828,572	236,485	255,368	17,349
1931 ..	1,235,673	111,205	47,407	684,338	181,160	197,919	13,645
1932 ..	1,431,461	130,640	30,031	838,799	201,233	219,619	11,138
1933 ..	1,917,220	131,163	42,022	1,181,146	328,799	220,328	13,761
1934 ..	2,282,602	125,935	48,513	1,413,856	415,842	262,644	15,812
1935 ..	2,472,236	147,496	45,109	1,507,620	468,616	286,292	17,103

Exports (in percentage)

1926 ..	100.0	2.4	4.8	6.9	43.1	41.7	1.1
1927 ..	100.0	2.7	4.6	6.9	42.8	41.7	1.3
1928 ..	100.0	2.4	5.9	4.6	43.7	41.2	2.2
1929 ..	100.0	2.2	5.2	4.2	42.5	43.6	2.3
1930 ..	100.0	2.9	5.9	4.4	37.2	47.0	2.6
1931 ..	100.0	3.3	5.6	4.0	38.2	46.5	2.4
1932 ..	100.0	1.9	5.5	3.7	36.9	49.7	2.4
1933 ..	100.0	1.6	6.9	4.0	30.0	55.4	2.1
1934 ..	100.0	2.2	5.7	4.4	23.9	62.0	1.8
1935 ..	100.0	2.1	5.8	4.4	26.9	58.1	2.7

Imports (in percentage)

1926 ..	100.0	10.2	4.5	56.4	15.0	13.2	0.6
1927 ..	100.0	10.2	4.6	55.2	16.0	13.3	0.7
1928 ..	100.0	9.5	4.1	53.1	17.4	15.2	0.8
1929 ..	100.0	9.6	2.6	55.2	16.0	15.6	0.9
1930 ..	100.0	9.5	3.9	53.6	15.3	16.5	1.1
1931 ..	100.0	9.0	3.8	55.4	14.7	16.0	1.1
1932 ..	100.0	9.1	2.1	58.6	14.1	15.4	0.7
1933 ..	100.0	6.8	2.2	61.6	17.2	11.5	0.7
1934 ..	100.0	5.5	2.1	61.3	18.2	12.1	0.7
1935 ..	100.0	6.0	1.8	61.0	19.0	11.6	0.7

B. Food Not Acute Problem

A moment of digression may not be amiss at this point. Curiously enough, however, statistical returns are more optimistic on the matter of food supply to the nation, and they do not seem to indicate the condition being as acute as is generally heralded. The following table may support this contention. This is due to the development of food supplies of her colonies, namely Chosen (Korea) and Taiwan (Formosa), and the introduction of these to Japan, along with the constantly improving system of production throughout the Empire.

For the first time in many years, in 1935, Japan breathed a sigh of relief when the export of her foodstuffs amounted to five million more than the import of the same. The experience of one year is no assurance for the next. Nevertheless, this is the result of serious planning and determined execution, which are traceable in Table 2.

No one should, however, ignore the fact that popular apprehension does exist as to the ability of scientists and experts to assure that the increase in production keeps pace with the increase in population and, consequently, the attendant suffocating feeling due to the extensive markets or fields closing or closed to Japanese merchandise, migration or investment. For this moment, though, the problem is more psychological than actual, but nevertheless real.

Japan's Imports and Exports of Foodstuffs*

Table 3

(In millions of Yen)

Exports :	*1930*	*1931*	*1932*	*1933*	*1934*	*1935*
In natural state	42.1	37.7	26.8	30.3	48.3	51.8
Aquatic products	18.1	10.2	7.8	10.3	16.5	20.0
Beans and peas	7.2	5.1	5.9	7.2	9.1	5.2
Rice and paddy	6.6	15.8	4.8	2.1	8.4	6.7
Wholly or partly manufactured ..	86.8	64.6	77.6	127.7	123.6	145.3
Wheat flour	14.5	9.5	20.5	35.0	28.5	33.7
Sugar, refined	26.7	14.9	7.8	14.9	13.5	17.6
Tea	8.3	8.2	8.0	8.5	9.5	11.4
Comestibles in tin and bottle ..	21.8	18.9	22.8	47.0	50.3	57.1
Total	128.9	102.3	104.4	158.9	171.9	197.1

(" — " indicates excess of imports over exports)

Imports :	*1930*	*1931*	*1932*	*1933*	*1934*	*1935*
In natural state	147.6	111.2	130.6	131.2	125.9	147.5
Beans and peas	49.8	37.3	42.1	50.3	52.0	71.6
Wheat	41.5	32.9	49.6	44.4	40.7	43.2
Rice and paddy	19.6	7.0	12.2	11.5	0.7	3.3
Wholly or partly manufactured ..	60.7	47.4	30.0	42.0	48.5	45.1
Sugar	26.0	15.6	3.3	12.8	9.7	12.7
Total	208.3	158.6	160.6	173.2	174.4	192.6
Balance :	—79.4	—56.3	—56.2	—14.3	— 2.5	+ 4.5

*NIPPON A Chartered Survey of Japan 1936. By T Yano and K. Shirasaki. Kokusei-sha, Tokyo. p. 30.

Products Requiring Industrial Raw Materials

A. Cotton and Wool in World Market

The importance of cotton and wool to the industrial nations of the world, needs no further comment. According to the *Review of World Trade* of 1935 published by the League of Nations,

we are told that, in relation to cotton and wool, the following are some of the most important raw materials that are thrown on the international market :

	1932	*1934*	*1935*
Cotton	497	444	468
Wool	214	272	264
Rubber	45	138	114
Coal	255	211	211
Crude oil	137	142	151
Petroleum	194	126	127
Copper	84	118	134
Zinc	27	40	47
Zinc ore	24	29	25
Total	1,477	1,520	1,541

(In units of 1,000,000 gold dollars)

B. Case of Cotton in Japan

1. Extent of Raw Cotton Import :

The importance of cotton in Japan's export and import is, in turn, conspicuous. The table on the following page illustrates that the cotton requirements of Japan represent almost one-third of her total imports, and that while importation of raw cotton is steadily increasing, that of both cotton yarn and cotton goods is decreasing.

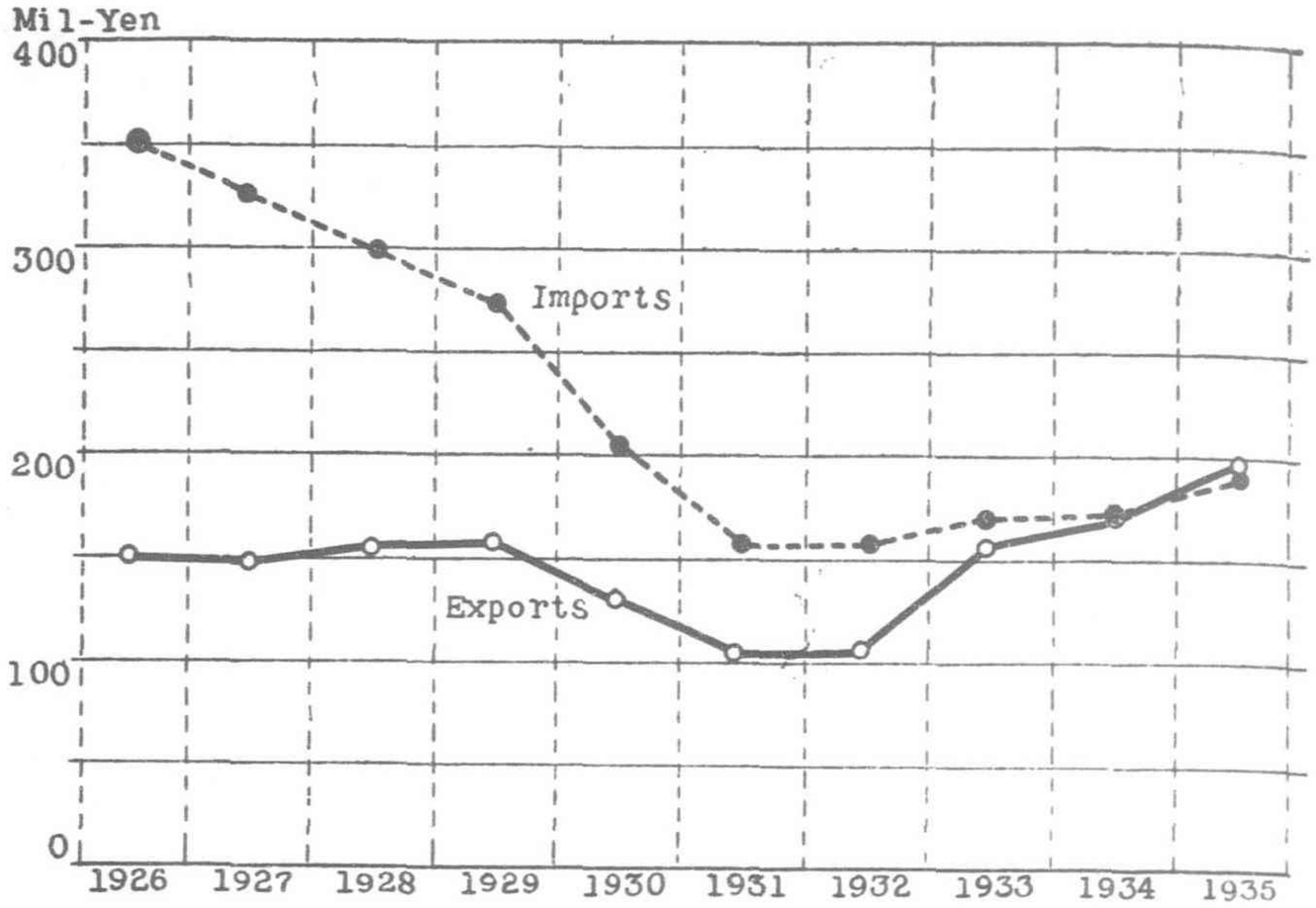
While the writer is not in possession of the total amounts of various manufactured fabrics, it is not impossible to discern the relative positions in Japan of several types of woven goods according to the figures of the Government Census Bureau issued in 1936.*

Total silk goods	Y554,542,431
Silk and cotton, mixed	46,328,231
Cotton goods	816,361,880
Hemp and goods mixed with hemp	18,515,326
Woollen goods and goods mixed with wool	264,131,170

*The output of the government establishments, and that of the houses employing less than five workers are not included.

JAPAN'S FOREIGN TRADE IN FOODSTUFFS*

Chart 2 :



* NIPPON A Charted Survey of Japan 1936. By T. Yano and K. Shirasaki. Kokusai-sha, Tokyo. p. 31.

2. Extent of Export of Manufactured Cotton:

In the same breath it is seen below that the export of cotton yarn and cotton goods, together with their kindred products constitute more than one-fourth of Japan's exports. Of these exports of cotton goods, with the exception of only 4 per cent which represents the re-exported raw cotton in 1935, 96 per cent is shipped from the country in a manufactured state.

C. Case of Wool in Japan

1. Extent of Raw Wool Import :

Coming now to wool, one cannot help noting a rapid decline in the import of top, and an equally rapid rise in the import figures of wool, which, within the last ten years more than doubled in value and trebled in quantity.

Import of Raw Cotton and Cotton Goods*

Table 4

(In unit of yen)

Year	*Raw Cotton*	*Cotton Yarn*	*Cotton Goods*	*Total*	*Percentage of Cotton to Total Import Trade of Japan*
1926	725,930,206	1,038,081	7,784,922	734,753,209	31
1927	624,630,660	909,402	8,586,355	634,126,417	29
1928	549,941,686	1,562,249	8,690,477	560,194,412	25
1929	573,016,350	1,798,829	9,803,482	584,618,661	26
1930	362,046,753	1,904,169	5,829,543	369,780,465	24
1931	296,273,329	15,550,566	4,976,845	316,800,741	25
1932	447,401,309	5,924,152	4,739,766	458,065,227	32
1933	604,847,269	14,476,546	3,398,120	622,721,935	32
1934	731,424,836	13,251,795	1,290,407	745,967,038	33
1935	714,261,940	5,153,240	1,511,365	720,926,545	29
1936	850,451,600	4,264,984	1,420,514	856,137,098	31

*Cotton Statistics of Japan. The Japan Cotton Spinners' Association Osaka, Japan.

Export of Cotton and Cotton Goods*

Table 5

Year	*Cotton Wadding*	*Cotton Yarn*	*Cotton Goods*	*Re-exports of Raw Cotton*	*Total*	*Percentage of Cotton to Total Export Trade of Japan*
1926	383,618	70,716,335	448,720,101	50,704,408	570,524,462	28
1927	331,263	38,794,408	418,578,846	57,566,452	515,270,969	25
1928	353,299	25,894,905	390,702,766	37,437,207	454,388,177	23
1929	120,451	26,755,702	454,846,703	28,762,629	510,485,485	24
1930	102,508	15,032,819	305,910,695	22,216,036	343,262,058	23
1931	74,915	8,510,607	221,381,265	15,788,479	245,755,257	21
1932	108,042	21,546,681	319,490,662	34,111,102	375,256,487	26
1933	155,541	15,712,038	431,825,710	18,138,044	465,831,333	25
1934	202,387	23,484,585	546,693,011	20,044,470	590,424,453	27
1935	238,648	35,873,277	628,915,126	23,241,118	688,268,169	28
1936	416,143	38,344,845	627,789,094	27,459,288	694,009,370	26

**Cotton statistics of Japan.* The Japan Cotton Spinners' Association, Osaka, Japan.

Import of Wool*

Table 6

(*Quantity in lb. Value in yen*)

Goods	*Top*		*Wool*		*Goat wool & Camel hair*		*Total*	
Year	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
1926	8,547,866	18,004,578	73,054,134	68,019,582	317,998	184,844	81,919,993	86,209,004
1927	5,967,466	11,529,894	99,238,934	90,146,836	353,016	188,445	105,559,416	101,865,178
1928	1,716,601	3,438,584	115,696,934	108,433,709	500,752	341,168	117,913,287	112,213,461
1929	707,200	1,142,674	107,948,668	100,673,152	335,650	289,876	103,991,518	102,105,702
1930	57,867	56,826	115,560,001	73,549,504	381,243	313,209	115,999,111	73,919,539
1931	149,066	124,373	190,571,601	86,021,343	653,239	376,133	191,373,906	86,521,849
1932	41,334	25,569	205,824,268	87,533,854	992,587	761,902	206,858,189	88,321,325
1933	64,266	101,479	240,714,666	164,090,353	1,841,560	1,626,208	242,620,492	165,818,040
1934	66,267	73,827	182,992,000	186,393,669	1,320,954	1,212,485	184,379,221	187,679,981
1935	77,201	93,221	245,386,844	191,667,650	1,811,477	1,330,711	247,275,522	193,091,582

*Tables on Wool Industry for 1935. Nippon Yomo-Kogyo-Kai (Wool Industry Association.) p. 16.

2. Extent of Export of Manufactured Wool :

Although Japan's woollen goods industry has made rapid strides, it is still insignificant as an export merchandise as compared with that of cotton goods, for we see in the following statistics that Japan has exported only small amounts to foreign countries within the last seven statistical years.

EXPORT OF WOOLLEN GOODS*

1928	Y.3,607,781	1932	Y.4,679,040
1929	4,306,991	1933	12,770,572
1930	2,845,652	1934	30,420,530
1931	1,489,677	1935	33,337,657

**Tables on Woollen Industries for Nippon, 1935.* Yomo-Kogyo Kai (Wool Industry Association). p. 21.

Relations Between Sources of Raw Materials and Markets

A. Case of Cotton :

We now come to compare the sources of cotton and wool supplies on the one side and their markets on the other. The following table shows the sources from which Japan secures her most important industrial raw material, namely, cotton. It will be seen that while the table gives a dozen source countries, only the United States of America and British India are the two really important suppliers. More than 93 per cent of Japan's raw cotton requirements are met by them, while the other ten or more countries are brought into the picture as conditions require.

The Export Returns of the Department of Finance give two major classes, namely :

I. Yarns, threads, twines, cordages and materials thereof.
II. Tissues and manufactures thereof.

The first group is, in turn, divided into hundreds. Take, then, cotton yarn which again is divided into four sub-classes. One of these, for instance, involves Y.17,393,061, of which British India consumes Y.14,529,935, and the remainder is distributed to 54 other countries.‡ Or, again, take another example from the second group, say—" Other Cotton Tissues " which comprises 28 classes, one of which is headed " Striped drill, yarn dyed "—its total value exported amounted to Y.19,139,836 of which Dutch India imported to the value of Y.4,228,394, the remainder being distributed to 89 other countries.‡

If we multiply these various classes of goods with the number of destinations, it is easily seen, that, whereas, the number of sources of Japan's raw materials is very much limited, the destinations of her products are scattered throughout the world.

Although we enumerated 12 sources of supply of raw cotton to Japan, we have already seen that imports from two sources—India and America alone—in 1935, amounted to 93.6 per cent, whereas she will have to seek over and above these 18 countries,§ namely, British India, Dutch India, Manchoukuo, Egypt, Argentine, Australia, Kwantung Province, the Philippine Islands, Siam, China, Hongkong, Straits Settlement, United States of America, Union of South Africa, Chili, Turkey, New Zealand and Hawaii, in order to dispose of more than 82.8 per cent of exported cotton tissues ; or as many as seven countries, namely, British India, Manchoukuo, Dutch India, Hongkong, the Philippine Islands, Kwantung Province and China, in order to dispose of 88.1 per cent of cotton yarn on the basis of the trade returns of 1935.

As we have seen at the outset, as regards wool, Japan depends entirely upon foreign countries to feed her mills. To date Australia has enjoyed a virtual monopoly in meeting Japanese demands. Normally, between 86 per cent (1934) and 97 per cent (1932) of Japan's wool supply comes from that continental island, although due to the trade dispute between the two countries in 1936, this trade quota undoubtedly faced a considerable setback.

‡Not necessarily independent, geographical terminology only.

§Listed according to their importance to Japan as customers.

SOURCES OF JAPAN'S RAW COTTON*

TABLE 7

(Quantity in unit of 100 lb. Value in unit of Y.1,000)

	British-India		*U.S.A.*		*China*		*Egypt*		*French Indo-China*		*Other Countries†*		*Total*		*Re-exports Raw Cotton*	
Year	*Quantities*	*Value*	*Quantities*	*Value*	*Quantities*	*Value*	*Quantities*	*Value*	*Quantities*	*Value*	*Quantities*	*Value*	*Quantities*	*Value*	*Quantities*	*Value*
1926 ..	7,820,376	327,521	6,029,831	317,428	1,159,033	45,134	340,863	28,682	11,741	153	165,745	7,012	15,527,589	725,930	1,012,348	50,704
1927 ..	6,656,007	202,282	8,479,544	343,563	1,397,501	49,259	317,843	21,798	41,517	907	174,061	6,822	17,066,473	624,631	1,269,076	57,566
1928 ..	6,133,571	232,267	5,162,133	245,925	1,388,729	49,596	234,299	17,722	9,192	94	87,307	4,337	13,020,231	549,942	786,331	37,437
1929 ..	6,848,624	231,108	5,980,198	276,358	1,038,183	33,629	307,783	21,899	5,829	93	205,478	9,929	14,386,095	573,016	636,625	18,763
1930 ..	6,300,592	147,633	5,177,984	176,801	937,128	21,935	243,448	12,592	26,903	507	78,156	2,474	12,764,211	362,047	627,145	22,216
1931 ..	6,411,003	113,262	7,094,696	153,701	950,686	17,366	382,892	11,619	3,500	19	32,809	306	14,875,768	296,273	696,900	15,788
1932 ..	3,653,123	91,747	12,135,584	320,752	708,797	18,886	440,483	15,300	1,844	28	47,044	688	16,986,875	447,401	1,275,043	34,111
1933 ..	5,303,040	168,797	9,913,173	381,656	758,760	24,348	373,939	19,084	9,627	111	293,729	10,851	16,652,268	604,847	490,924	18,138
1934 ..	7,723,177	252,435	8,648,975	400,919	440,859	15,693	732,735	39,787	9,948	161	517,442	22,430	18,073,136	731,425	521,799	20,044
1935 ..	6,948,052	259,037	7,677,907	371,952	569,880	20,705	715,889	43,009	9,775	135	456,816	19,424	16,378,319	714,262	533,992	23,241
1936 ..	8,969,259	315,061	7,904,995	372,415	618,592	22,778	593,951	36,415	5,288	68	2,189,473	103,714	20,281,558	850,451	713,481	27,459

**Cotton Statistics of Japan :* The Japan Cotton Spinners' Association, Osaka, Japan.
†Include Rangoon, Turky, Persia, Peru, Brazil.

SOURCES OF JAPAN'S WOOL SUPPLY*

TABLE 8

Quantity in lb. Value in yen)

Imported from	*1932*		*1933*		*1934*		*1935*	
	Quantity (lb.)	*Value (Yen)*	*Quantity*	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
Manchoukuo	26,800	14,619	83,600	47,554	108,268	59,683	25,067	14,977
China	81,068	67,906	186,002	128,532	634,001	323,953	230,533	94,828
Straits Settlement	—	—	37,600	15,218	29,067	16,233	53,067	17,135
Great Britain	532,799	354,006	1,186,933	1,007,729	778,134	842,954	684,534	663,075
Peru	—	—	—	—	163,199	137,329	83,200	63,737
Chili	111,333	22,116	1,658,934	464,813	1,021,199	1,034,166	1,432,800	875,246
Argentine	1,079,333	481,106	4,122,400	2,427,232	7,918,933	7,552,655	947,600	611,568
Uruguay	—	—	192,134	134,428	1,430,667	1,496,374	1,683,466	1,372,104
Other S. Am. Countries	150,801	89,689	24,933	10,838	45,333	34,705	19,067	10,073
U. of South Africa	2,318,135	1,031,553	3,919,465	2,558,858	4,978,934	5,442,837	2,586,844	1,872,253
Other S. Af. Countries	—	—	1,066	455	219,600	240,882	7,467	3,814
Australia	198,420,666	84,241,990	227,395,868	156,455,354	155,375,999	159,241,408	230,269,467	182,007,020
New Zealand	2,992,134	1,189,643	1,835,065	792,354	10,187,733	9,904,295	7,275,133	4,006,846
Other Countries	111,199	41,226	70,666	46,988	100,933	66,195	87,599	54,974
Total	205,824,268	87,533,854	240,714,666	164,090,353	182,992,000	186,393,663	245,386,844	191,667,650

**Tables on Wool Industries for 1935 :* Nippon Yomo-Kogyo-Kai (Wool Industry Association.) p. 17. Included in the imports from other countries.

B. Case of Wool

In the year 1935, when Japan's export of woollen goods amounted to Y.33,337,657, there were only nine countries scattered far and wide throughout the world that consumed more than one million yen worth of this Japanese merchandise, while the remainder went to no less than 38 countries* including Brazil who patronized Japanese goods to the extent of Y.3,730.

*Geographical terminology only.

Export of Woollen Goods*

Table 9

(1935)

Destination	*Value*
Kwantung Province	Y.8,957,462
British India	5,123,608
Hongkong	3,379,989
China	3,082,935
Egypt	2,291,147
Manchoukuo	1,449,366
Union of South Africa	1,395,598
Dutch India	1,219,356
Other countries	6,438,196
Total	Y.33,337,657

**Tables on Woollen Industries for 1935.* Nippon Yomo-Kogyo Kai (Wool Industry Association). p. 21.

Although it is apparent that these figures point towards a further development in the woollen industry, at present, Japan herself is the customer of 89 per cent of wool manufactures, exporting only a little over 11 per cent of the total. Hence, it is not like the case of cotton where Japan almost pays for her raw materials with the export of her manufactured cotton goods. Japan buys, say, 95 per cent of her wool requirements from Australia and consumes approximately 90 per cent of her own woollen manufactures. It goes without saying, therefore, that Japan must have either Australia or some other nation take something else that she can offer to the world market.

Fortunately, Japan produces Y.554,542,431 worth of silk goods, for the raw materials for which she pays practically nothing to foreign countries, and with which theoretically, at any rate, she pays for wool from Australia.

But this depends upon the condition that some one else buys Japan's silk goods. However, unfortunately, that customer expects Japan to buy something in return. According to the trend of the world trade to-day, the countries similarly situated as Australia, therefore, is expected to square up the account with Japan or the countries of the type.

Concluding Remarks

Having ascertained that Japan's foreign trade, too, is one mesh in the intricate net work of international economic relations, her problem must be said to be two-fold: (1) co-operation and co-ordination with her neighbors, as we have already seen, inasmuch as Japan plays no effective rôle in bringing raw materials to the world, and she must depend upon the goodwill of her customer countries, and (2) rationalization of her economic organization so as to enable her to attain the greatest return for the largest number of her people by serving the largest number of her customers, in the process known as international trade. Hence, it is only in playing this natural rôle in collaboration with other countries that she can expect to take an active part in restoring the regime of economic freedom throughout the world.

A. General International Co-operation

It is true that under normal circumstances the problems of access to raw materials is negligible. But the purchasing capacity of a nation like Japan from a given country depends upon the amount that the latter, or other countries, buy from her.

If a country from whom Japan obtains her raw materials restricts its importation of Japanese goods, it would not only disappoint the Japanese merchants but greatly affect their ability to buy from abroad.

This would drive her to patronize another source of raw materials which might most likely purchase Japanese goods, but which is not necessarily capable of furnishing them raw materials as advantageously as did the first source.

This would result in the increase in the cost of production, and consequently shift the burden to the consumer. This, in turn, will undoubtedly reduce the volume of purchase by the consuming country. This will result:

(*a*) In a greatly reduced volume of trade, if not in a total collapse of the trade; or else
(*b*) In the use of substitute, or
(*c*) In a struggle for freer access to raw materials and markets.

Thus unbridled trade battles and skirmishes have been going on and may go on apparently without any check.

(1) Some of the producers of raw materials hold that a system of barter should be instituted and that it should operate between the participants on an even monetary basis of dollar for dollar.
(2) Still others insist that manufacturing nations should buy more in return from the former, inasmuch as more people are employed in manufactures than in the production of raw materials. They claim that they are helping to furnish the opportunities for employment.

In examining the first theory on the face of it, it sounds rather reasonable, especially when the even amount of exchange is taken into consideration between two countries. However, in actual practice, it is impossible to take the balance of payment between two countries only; besides, the exchange rate between nations fluctuates too often to allow them to emerge evenly. Again, even when one item of transportation service is taken into consideration, it is self-evident that the raw products are necessarily more voluminous than manufactured goods, which, for the same volume, represents a much higher value. In other words, an even barter between two countries is bound to produce a one-way and most uneconomical freight traffic.

Secondly, the so-called "barter" of to-day is not like that of the old, where it consisted in the exchange of primary products by the producers themselves, in which only nature and the barterers were concerned in the process. But the barter of to-day operates through the whole ranges of international trade machineries. It deals not only in primary products, but, rather, in highly finished and manufactured merchandise. Hence, the net share of the countries in the process of bartering that offer primary products, is relatively high as compared with the manufacturing countries whose export prices include the cost for service charges, labor and overhead expenses, interest in the investment, and profit—in addition to the cost of raw materials. The net share, therefore, of the countries poorly endowed in natural resources, such as Japan, represents only the service charges, wages, salaries and interest by which the nation must work out its salvation for a rapidly increasing standard of living.

It is understood that the ultimate aim of "peaceful change" is to restore or bring about a permanent regime of abundant supply and consumption of goods with the least possible restriction among nations that engage in production, exchange, and consumption.

As we understand it, three types of remedy in the way of international arrangements have been suggested, namely, bilateral, local, and general.

I. It has been proposed that a series of bilateral agreements might be effected in order to alleviate the situation. If the conditions of the agreements were more or less common to all, they might succeed in answering the purpose of the agreements for which the countries entered.
II. However, the agreement between certain two or more parties might result in handicaps to some of the neighboring parties with whom they have intimate economic relations and among whom it may provoke the creation of a like unit in self-defence.
III. Therefore, in the last analysis, it is not in a series of bilateral agreements or even in bloc economy that the final solution of the world's economic ailment lies; rather, it is in a return to the regime of freedom of trade and of removal of trade barriers.

B. Intra-national Co-ordination

We have thus come to the second phase of the problem of a nation similarly situated as Japan. Once more we will resort to the case of Japan to illustrate the point of rationalization through international co-ordination. Inasmuch as Japan must depend upon

raw materials of foreign sources and purchasers of her manufactures for the well-being of her people, their activities are circumscribed by these two extremes of economic processes. In other words, she must fill in the gap between these ends most profitable to themselves and agreeable to others.

It is not easy to make an estimate of what the income is to the Japanese nation for industries using foreign raw materials. Even an average is not easily obtainable, inasmuch as there are so many classes of goods and the expenses of each class are apportioned differently. For instance, the cost of labor for superior goods is higher than that for the inferior. However, taking cotton piece-goods as an example, it is roughly, and roughly indeed, estimated that approximately 62.6 per cent represents the cost of raw materials, 34.8 per cent the wages, salaries, management fees, interests, and profits to factories, and 2.55 per cent, the portion that goes to the merchant—wholesale, retail and commission. So much for the domestic aspect of the market price. In the case of exports counted on the basis of c.i.f. in foreign ports, prices in Japan will come to approximately 85 per cent in the case of superior goods, 80 per cent in the case of the inferior; 11.5 per cent for charges of all sorts, including freight, interest, insurance, damage, etc.—of the latter, 3½ per sent and 3 per cent respectively as profit to the export merchant.

Analysis of Market Price (1936)*

Table 10

of Cotton Piece Goods of 61 Tans of No. 20 Threads

(Consuming about 466 lb. of raw cotton as a unit)

Handled by	*State of Production*	*Cost Price*	*Cost of Production*	*Commission*	*Market Price*
(1) Cotton importer ..	Raw cotton	177.00	none	none	177.00
(2) Yarn mill ..	Cotton yarn	177.00	25.00	12.50	214.50
(3) Yarn wholesaler ..	,, ,,	214.50	none	.50	215.00
(4) Yarn local dealer..	,, ,,	215.00	,,	.60	215.60
(5) Weaving mill ..	Grey	215.60	24.40	Inc. in the foregoing	240.00
(6) Grey cotton dealer	,, ,,	240.00	none	3.05	243.05
(7) Dying works ..	Mfd. cloth	243.05	36.60	Inc. in the foregoing	279.65
(8) Wholesaler of mfd. cotton cloth or direct exporter ..	,, ,,	279.65	none	1.525	281.175
(9) Retailer or smaller exporter ..	,, ,,	281.175	none	1.525	282.70

	Cost	*Percentage*
Raw materials	177.00	62.61
Cost of production	98.50	34.84
Cost of distribution	7.20	2.55
Total	282.70	100.00

*Rough estimate only *Shoko Keizai* No. 3, Vol. III, March 1937, Tokyo. p. 102.

According to a table prepared by the Tokyo Chamber of Commerce and Industry, the portion of the cost of production that was allotted to workers during the period 1929—1933 was between 8.1 per cent—10.8 per cent. It is approximately within these small percentages that Japanese wage-earners are required to work out their salvation and raise their standard of living, though it must be remembered that per capita wages of Japanese laborers represent only 78.5 per cent of their receipts, some of these are given them in welfare work to the amount of 18.7 per cent and relief funds to the amount of 2.7 per cent of their income.

Ratio of Raw Materials and Wages*

Table 11

	1929	*1930*	*1931*	*1932*	*1933*
Total cost of production ..	100.0	100.0	100.0	100.0	100.0
Raw materials	60.7	60.3	58.7	56.9	69.7
Wages	9.7	10.8	10.6	9.4	8.1
Others	29.6	28.9	30.7	32.7	22.2

**The Industries of Japan*. Number 1. General Treaties. Tokyo Chamber of Commerce and Industry. Tokyo, Japan, p. 71.

Based on the "Statistical Tables concerning Factories" compiled by the Department of Commerce and Industry, not including electric and gas industries.

Again making the cost to importers abroad as one hundred, we find roughly the figures below. As will be noted, freight, insurance, etc., occupy a goodly percentage. A small per cent is set aside for the exporter in each case. In addition, we are told that the charges for transportation, insurance services, etc., occupy 11.5 per cent in the case of the goods above average and 17.0 per cent in the case of the goods below average.

Analysis of the Cost (C.I.F.) of Japanese Cotton Fabrics

Table 12

	Goods above average	*Goods below average*
Cost to Japanese exporter	85.0%	80.0%
Profit and commission to exporter ..	3.5	3.0
Freight, insurance, etc.	11.5	17.0
Total cost to importer abroad ..	100.0%	100.0%

From a foreign importer's point of view, the cost of raw materials of Japanese cotton fabric is, for the sake of convenience, we will say—85 per cent *times* 62.61 per cent which equals 52.7 per cent for the goods below. Hence, he may contend that the Japanese should rationalize their production both in labor and machinery to make the most efficient and profitable distribution within their nation of 35.8 per cent of the price for the goods he pays for the former and 32 per cent for the latter.

From a Japanese point of view, it may be said to be the following: they must be assured of a steady or increasing supply of raw materials to the amount of 62.61 per cent of the cost price for which they ship their goods abroad; in addition, they see with anxiety the rising charges in freight, insurance, etc., over and above the already telling high rate of 11.5 per cent for goods above average and 17 per cent for goods below. They see that when they are thus circumscribed by the lack of raw materials at the initial stage of production, and the disturbing figures of freight, insurance and others at the next to the last stage, even without insurmountable high tariff walls, quotas, restrictions or the diversion policies. It may be too much to hope for any sudden and revolutionary change. Indeed, it is preferable that it should be gradual and evolutionary. Nevertheless, the start toward the right direction is the step to which the world now looks with eager anticipation.

To that end, the free exchange of frank views, and even the passage of resolutions seeking for the desired trade regime, would afford, at least, a beacon light of hope to this troubled world. In short, anything that will give relief to the psychological tension or throw a little light on this difficult question through international action would be of great value at this time. It is preferred that this should take some form of crystallized international action, tending to give impetus to a new world trend.

China's Postal and other Communications Services

(Continued from page 254)

tions, and commercial aviation. It was Mr. Wang Po-chun who, becoming the first Minister of Communications, constituted a solid Government policy in regard to Communications. His spirit is still felt, and the author frankly admits that Mr. Wang's fundamental guiding principles were carried out during his tenure of office and the expansion of the policy laid down by the first Minister of Communications should be the concern of those, charged with the responsibilities of the Ministry.

One of the phenomenal developments in the Chiaotungpu has been popularity of the Postal Remittances & Savings Bank. Since its establishment in 1930, the total deposits have grown from $14,553,201 with 84,778 depositors at the end of that year, to a record high of $53,408,319 with 252,852 depositors at the end of June, 1936.

Dr. Chu Chia-hua recounts the strides that have been made in marine and navigation administration, telegraphs, telephones and wireless, commercial aviation, and accounting. New enterprises in these fields are reported almost every week, the latest and most outstanding being the inauguration of radio-telephone service between China and America during the Sino-American Trade Week.

The last contribution to the *China To-day* Series, which is edited by Mr. T'ang Leang Li, represents a timely document, and Dr. Chu Chia-hua is well qualified to analyse the moving spirit of reforms and improvements that were achieved by the National Government during that brief period of Modern China's history.

The Maintenance of Steel Structures in the Far East—Corrosion and Typhoons

By C. A. MIDDLETON SMITH, M.Sc., M.I.Mech.E. (Taikoo Professor of Engineering in the University of Hongkong)

THE rapid progress made in recent years in applied science developments in the Far East has not been accomplished without anxiety for engineers concerned with the maintenance of structures and machinery. Mr. P. Taylor, A.M.I.MECH.E., recently reminded the members of the Engineering Society of China, in Shanghai, of disastrous calamities that have taken place in the International Settlement in recent years. In February, 1933, a rubber vulcanizer exploded. It was accompanied by an intense fire and 81 persons were killed. As a result of the investigation by officials of the Shanghai Municipal Council, subsequent to the disaster, it became evident that industrialization in China has developed more rapidly than the technical knowledge and experience of many Chinese engaged in the manufacture and maintenance of engineering equipment, used in Chinese factories.

There can be no doubt that time has arrived when a greater effort should be made by Chinese Central and Provincial Governments to enforce rules and regulations to safeguard workers engaged in mechanized industry in China.

The investigation into the boiler situation in the International Settlement revealed seven unsatisfactory conditions, each distinct in itself, and each making its own contribution to the dangerous state of affairs which produced many disasters. They were (1) unsuitable location (2) bad design (3) poor quality of material (4) lack of supervision during manufacture (5) faulty installation (6) lack of proper maintenance and (7) inefficient attendants.

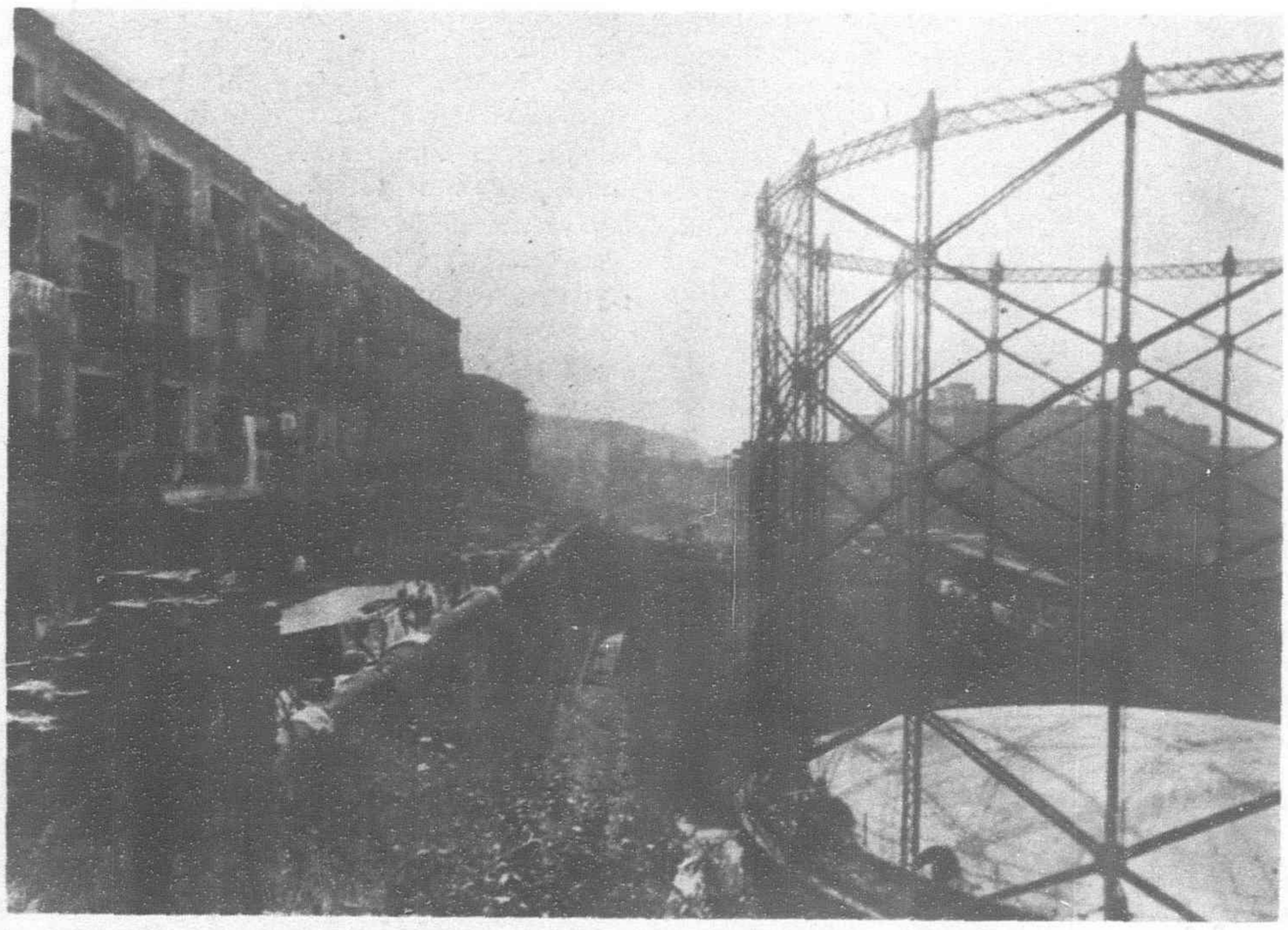
The Shanghai Municipal Council has now formulated rules with respect to steam plant installations and other systems under pressure. This is a step which shows that civic conscience has been aroused in official circles. It is to be sincerely hoped that further investigations, to safeguard industrial workers in Shanghai, will be carried out. It is still more urgent that the Chinese Government should give close attention to these problems.

The Hongkong Government has insisted on a system of inspection of factories, etc., by qualified men. But—as an historic example such as the failure of the Quebec bridge, demonstrated—however careful the supervision may be, catastrophes do occur from time to time. There have been, in some cases, factors that produced the disaster that were unknown to, or beyond the control of, those concerned with the design or maintenance of a structure. As a result of a subsequent inquiry new information concerning forces or the behavior of materials is obtained. A great deal of our present knowledge has been acquired as a result of past failures.

A Terrible Boiler Explosion

It must, however, be emphasized that however careful may be the supervision by qualified engineers, disasters do take place. At the time of writing an official inquiry is being held in Hongkong concerning a terrible boiler explosion which took place on a steam launch in the harbor. The boiler was 26 years old, the available life of a launch boiler being reckoned as 40 years. This launch boiler had been repeatedly inspected by well qualified Government Marine Engineers. The last inspection took place about five months before the explosion, when the boiler was certified as fit for service. The explosion caused 35 deaths and many persons were injured. At present the cause of the disaster has not been discovered. The writer has inspected the salvaged boiler and hazards the opinion that the plate in the shell of the boiler which failed had become fatigued, due to the difference in pressure when the boiler was under steam and when fires were drawn. That does not seem a very convincing explanation, but it is the only one that commends itself to the writer as the safety valve is said to have been in good order. Whatever the cause of the disaster it was not due to lack of care on the part of the local Government. On the other hand to-day's cables relate that a launch boiler exploded near Canton, causing many casualties. It is probable that the boiler had been built of poor material as so much of the steel imported into China is of bad quality.

The rapid industrial progress that is taking place in China makes it probable that, in the large cities which are developing, arrangements will be made to supply town gas for domestic and industrial purposes. As far as the writer is aware Shanghai and Hongkong are the only two centers in China where a public supply of this useful fuel is available at present. The recent researches on gasholders, subjected to high velocity winds are, however, of interest not only to engineers connected with the gas industry, but to all engineers interested in structural work. For the typhoon wind velocities experienced in the Far East—in Japan as well as on the China coast—provide factors that have not been previously fully investigated by engineers in any part of the world. In Europe recent researches on the subject have been carried out. It is practically certain that they were arranged as the result of an inquiry made in Hongkong concerning the collapse of a gasholder in the Colony. They were commenced some time after the newspaper reports concerning that calamity had been published. The circumstances in Hongkong connected with the failure of the holder were so unusual that they attracted the attentior of engineers in many parts of the world.



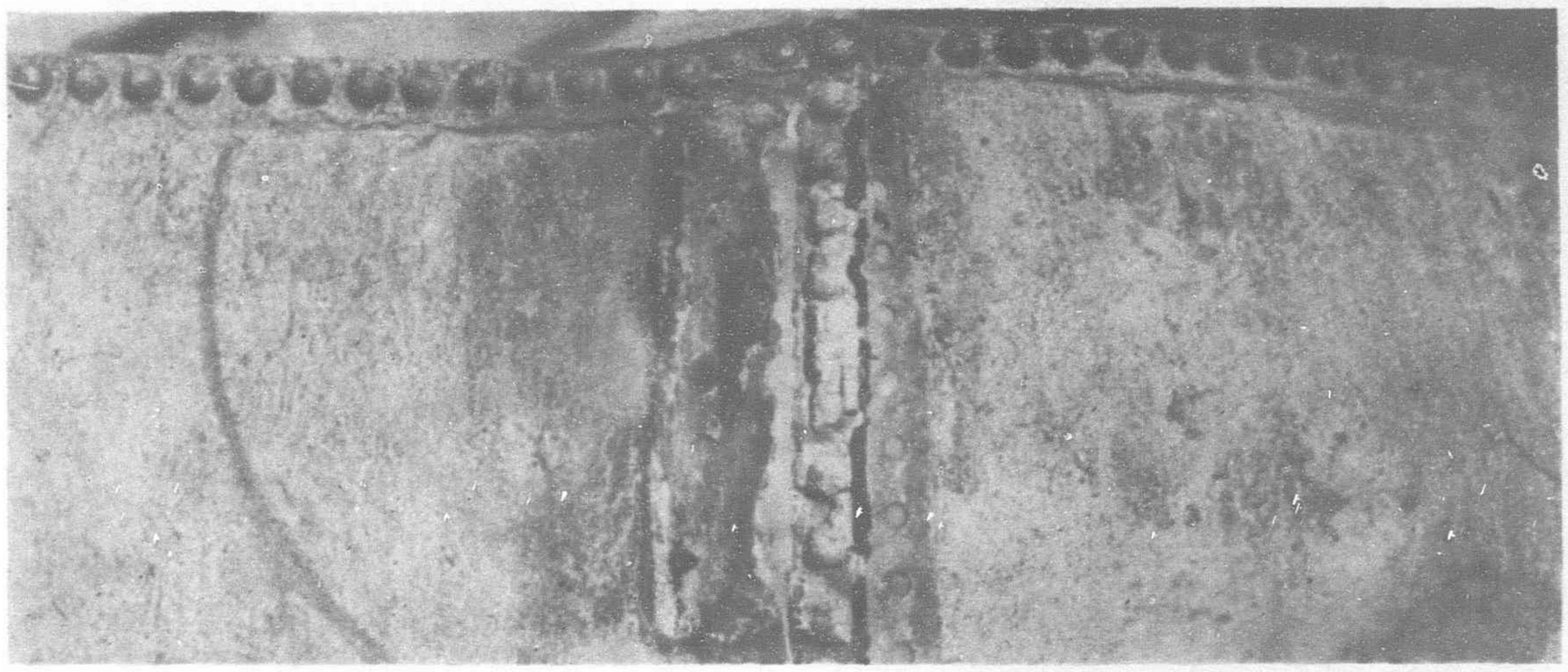
The Gasholder deflated and the row of houses burnt out by the fire

A Terrible Fire

More than three years ago, on May 14, 1934, there was a terrible conflagration of about 300,000 cubic feet of coal gas at West Point, Hongkong Island. This was caused by the failure of the envelope of a gasholder. An official enquiry, in the form of coroner's inquest, proved that there was no negligence in the design or the maintenance of the holder. It was a catastrophe which, the writer is convinced, could not have been avoided by any human foresight.

Having attended many sittings of the

Coroner's Court, and having fully investigated all of the technical aspects of the case, the writer is convinced that it was beyond human power to foresee the possibility of the catastrophe. In short, no one could be blamed for this sudden and unexpected tragedy. With every sympathy for the victims, it seems that the calamity can be compared with one caused by some unusual sport of Nature, such as a thunderbolt or an earthquake.



The picture shows the excessive corrosion at one of the rivetted joints of the 1/10th inch steel plates that formed the envelope of the gasholder

The Corrosion Theory

The holder that collapsed was a huge structure, most of it being made of sheet steel. It was 94 feet in diameter and, when at its maximum height, it held about 400,000 cubic feet of coal gas. A number of thin steel plates, rivetted together, formed an envelope to enclose the coal gas.

The actual pressure inside such a holder is comparatively small—only about half-a-pound per square inch above atmospheric pressure. A paper bag can stand that pressure. It was impossible to increase the pressure of the gas *inside the gasholder* beyond about half-a-pound.

Witnesses proved that the holder was below its maximum height—it was said that it held about 300,000 cubic feet at the time of the trouble—so that it is obvious that there was no unusual pressure within the structure.

What then caused quite a large area of one part of the envelope of the circular tank to collapse? The most obvious answer, of course, is that there was great corrosion of the steel plates. Indeed corrosion was evident. But what caused the unusual corrosion? And it seemed most unlikely that a big plate area would suddenly fail from corrosion only. It must be emphasized that there is no record of the failure of a holder, due to corrosion, in any part of the world in any way similar to this case.

Since its erection in 1908,—whenever there were signs of corrosion on the outside of the holder, patches were put on. The outside was frequently inspected. At intervals pin holes were noticed—that is the way corrosion on holders is detected. A small hole appears in an otherwise sound plate. But when the Hongkong holder collapsed a large area of plate—several square feet—opened to allow the gas to escape.

No "Explosion" in the Holder

Let us be quite clear about corrosion. First of all, the holder was nearly full of coal-gas, and we were told by three gas engineers at the inquest that in the process of the manufacture of coal-gas it is impossible for air to get inside the gasometer. So that there was very little chance of corrosion, on that part of the holder which does not touch the water seal, due to the gas. There must be oxygen for corrosion. If there were holes in the holder, the coal-gas would leak out but the air from outside could not leak into the gasometer. And only a mixture of about 84 per cent air and 15 per cent gas by volume will cause an explosion.

The rumors about "an explosion," inside the holder, can therefore be ignored. And if there had been "an explosion" inside the holder there would have been very little of the structure, or the surrounding district, left. There was a terrible conflagration, but no "explosion" inside the holder. The 300,000 cubic feet of coal-gas simply burnt as a huge jet in the atmosphere. There was a detonation of sorts (something like that which happens if you delay the ignition of an ordinary gas-ring), when ignition took place. That set up a big air wave and caused people to talk about the explosion of the holder. The gas ignited in the air outside the holder. The terrific flame burnt itself out in a few seconds. And the heat evolved passes the imagination. Once the jet caught fire, the flame spread from one end of the column of gas to the other, in a minute fraction of a second.

We can assume that each cubic foot of coal-gas gave out at least 400 British Thermal Units during combustion. That is to say, the 300,000 cubic feet of gas gave out the prodigious total of 120,000,000 British Thermal Units. That amount of heat was more than enough to have boiled 500 tons of water into steam, if the water had been supplied at the temperature of the mains. In a few seconds enough heat was given out, therefore, to raise that weight of water to boiling point and to change it into steam.

Unfortunate Circumstances

It is small wonder that people, some distance from this awful flame, were simply roasted alive. In more than one case a victim, outside of the houses, and not in the line of the flame, had all the skin burnt off the body, but did not collapse. The shock probably was so great that very little pain was felt at the time by many of the victims.

Indeed it was a curious feature of the calamity that although victims appeared to onlookers to be terribly burnt, they seemed to be almost indifferent to the burns which looked so dreadful. It was with great difficulty that some of the victims, badly injured, were persuaded to go to the hospital.

Of course no one was ready for the emergency and every helper did all that was possible. But it is not improbable that some of the help was worse than useless. The only real assistance for the victims was in the hospital, fortunately not far away. But there was inevitable confusion, because of the suddenness and the unreality of the whole thing. Burns treated on the spot were, in some cases, probably dealt with in the wrong manner and resulted in blood poisoning. That statement in no way reflects upon the good will, and the courage and fortitude, of the helpers. It was terrible even to look on to the almost naked sufferers—and yet it was amazing that the victims did not cry out with pain.

The real tragedy of this terrible accident was the direction of the wind at the time. Had it been blowing in the reverse direction the terrific flame would have burnt itself out into an earth embankment and practically no damage would have resulted. The majority of the victims were trapped in adjacent houses which rapidly caught fire.

There was a great deal of comment at the time of the catastrophe concerning the fact that a dwelling house was within eighteen feet of the gasholder, with no high wall between. It would have been quite possible for anyone on the verandah of the dwelling house to throw a stone on to the gasholder. But thousands of holders are situated near to dwellings in many parts of the world. No one had ever thought that a holder would fail during the first 40 years of its life. Many thousands of holders had survived that period and none had failed on account of the cause of failure in Hongkong.

It should be explained that houses had been erected near to the Hongkong holder, in the line affected by a prevailing wind, although there were no houses in most of the other directions. And it is only fair to the Gas Co. to state that the houses were not erected on their property, and that they were built some time after the holder had been in operation.

Local Conditions

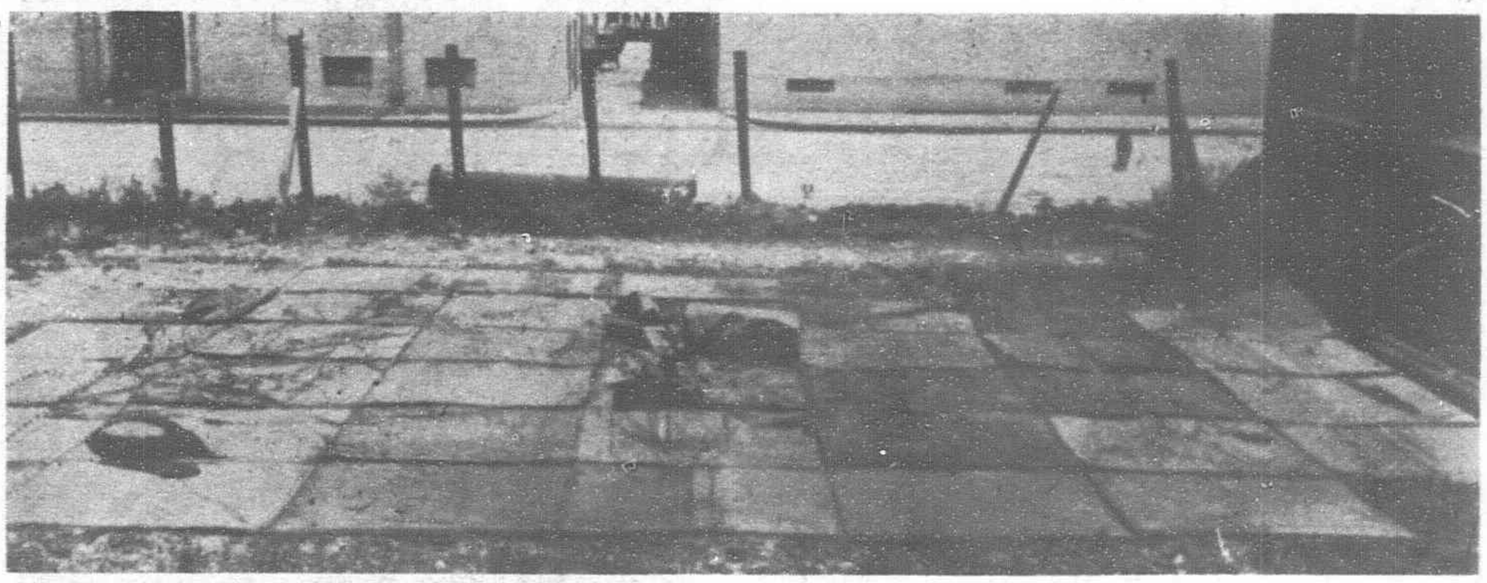
Another fact worth mentioning, to emphasize the peculiar circumstances conspiring to cause this tragedy, is the location of

the doomed premises. The city of Victoria, on Hongkong island, is built on a steep hillside and on ground reclaimed from the sea. The base of the holder was situated about 50 feet below the ground floor of the houses burnt out. In other words, the houses were on the hillside and were from 50 feet to 80 feet above the holder, just at the right height to catch the escaping gas. Had those houses been on the same ground level as the holder, the escaping gas from a vent 75 feet above ground level would have been swept away above the top of the houses and might never have ignited. Of course the position of the houses had nothing to do with the cause of the failure of the holder; but the houses, it seemed probable, had fire within that ignited the gas and so affected the number of casualties that resulted from the fire, as they were inhabited. One other fact concerning location is important. There was a street running E. by N. behind the holder and it acted as a funnel for the N.E. winds that struck the holder.

There were two problems, which the Coroner and jury who investigated the cause of death of an Indian watchman—and, of course, the cause of a total of 42 deaths and about 46 victims of serious injuries to those burnt by the fire which occurred—near the gas-works in Hongkong on May 14, 1934, tried to solve. They were (1) What caused the gas to escape from the big tank of sheet steel that had been in operation since 1908 (2) What caused the gas to ignite. Both problems were difficult to solve.

Stated briefly, the writer believes that some of the steel plates, forming the envelope of the holder, were weakened over a period of years by stresses due to high velocity gales in Hongkong, and that finally (14/5/34) the collapse of the holder was produced by a partial vacuum on the S.W. side of the holder on that date; the partial vacuum being caused by a N.E. wind. That partial vacuum produced a suction effect on the plate, causing it to be forced outwards in the S.E. direction. Nobody connected with the design or maintenance of gasholders, before the tragedy in Hongkong, had been aware of the importance of this suction effect, or indeed, of the data concerning it.

It is not unusual to read of the "bursting effect of tornados"; our local typhoons are similar to tornados. It was, doubtless "the bursting effect," the full stress of which had never been realized by engineers before the date of this failure, that caused the plate or plates to "burst" outward at the rivet joints.



A view of some of the plates forming the envelope of the gasholder spread out on the ground after the catastrophe

Typhoon Wind Effects

The effect of a wind striking a cylindrical body of the shape of the gasholder is known to be as follows:—

(*a*) There is a pressure on the windward side, varying in intensity with the velocity of the wind.

(*b*) There is a partial vacuum produced on the leeward side by the "suction effect" of the wind. In the case of the gasholder the maximum effect—i.e. the greatest vacuum—is produced near the top of the holder. The plate (or plates) that failed were at the top of the holder. The vacuum there is due (*a*) to the wind velocity over the roof and (*b*) to the wind velocity on the vertical height of the holder. But recent researches made since the calamity in Hongkong reveal that this vacuum is of a value startling and unexpected.

If we assume the usual atmospheric pressure of 14.7 lb. per square inch, then the atmospheric pressure on the leeward side of the holder during a gale is now known to be much less—say 12 lb. per square inch i.e. 2.7 lb. less than atmospheric pressure. The gas pressure within the holder was rather less than $\frac{1}{2}$ lb. per square inch. Thus the bursting stress forcing the plates outwards might have been 2.7 lb. + 0.5 lb. = 3.2 lb. per square inch and not 0.5 lb. as was assumed to be the bursting stress.

Situated within the tropics, Hongkong is subjected at intervals to typhoons: frequently winds of high velocity are recorded—even a record as high as 130 m.p.h. has been noted. Records of wind velocity and direction are taken in the Royal Observatory, Hongkong. These records showed that during April and May of the year of the accident the wind was often East by North, with a velocity round about 40 m.p.h.

In order to understand the unusual circumstances that affected this failure it is necessary to emphasize the location of the holder. It is also essential to emphasize that a prevailing wind in Hongkong, of great intensity, is at certain periods of the year blowing constantly in the direction (E. by N.) taken by the flame that caused the tragedy. It is the writer's conviction that the wind was the real cause of the disaster, so that point of wind direction must be remembered. *The China Year Book* says of Hongkong. "The seasons are marked by the prevalence of the S.W. monsoon in summer and the N.E. monsoon in winter."

Corrosion of the Plates

Independent measurements of the thickness of various sheets (forming the envelope of the holder) made by Government experts and this writer, at different times, were in exact agreement. The original thickness of the plates forming the envelope was 1/10th of an inch. The maximum thickness of any sheet after the disaster was 1/10th inch and the minimum was 1/40th—the latter thickness on a sheet that was separated, during the disaster, from the envelope. The most obvious inference as to the cause of failure of the sheet was corrosion. But even 1/40th of an inch was sufficient to withstand the gas pressure of about 6 lb. per square foot, or 0.5 lb. pressure per square inch.

The curious fact that an examination of the holder soon revealed was this: At the time of the disaster the wind was (roughly) blowing in the E. by N. direction, which is the prevailing line of the winter gales. And the plates failed on the leeward side of the holder.

During an inspection of the holder, after the disaster, it became evident that the sheets that failed, and those adjacent to them, had been repaired much more than the plates diametrically opposite. Moreover the sheets, or plates, that failed, and those adjacent, had worn much thinner in the course of years, than those on the opposite part of the circumference.

In other words, if we consider the position of the holder when the wind was blowing in the (approximately) E. by N. direction, at the time of the disaster, then the plates on the windward side of the holder had been in past years comparatively speaking, unaffected by corrosion, whilst those on the leeward side had suffered much more from that enemy of steel plates than reasonably might have been expected in the period since erection.

It should be emphasized that the cause of failure of the holder was obviously a structural defect. It was not, as was so often assumed in Hongkong, anything to do with the fire. The failure of the structure caused the fire; but the fire had nothing to do with the original failure of the structure. It is, of course, true that because the envelope of the holder fell rapidly, other structural defects might have been caused to it subsequent to ingition, and the fire.

The wind was the main reason of the failure, although if the plates had retained their original strength (i.e. had remained 1/10th inch thick), the wind would not have done the damage. But it was the force of the gales (E. by N.) over many years, that caused the plates first of all to corrode rapidly and then finally to fail by the "bursting effect" of the suction effect on the leeward side of the holder.

It was a case of one of these curious phenomena that are usually only revealed after a detailed study made on account of some unexpected disaster. It is not too much to say that it is very doubtful whether anyone connected with the design or construction of gasholders had ever thought of the circumstances to

be related below. It certainly was absurd to suppose that any official of a gas-works should be expected to foresee the curious results that followed a most unusual combination of circumstances in Hongkong, fundamentally due to suction, and not to wind pressure.

The Thin Plates

The evidence of the three gas engineers at the Coroner's enquiry *re* the catastrophe proved that the general supervision and maintenance of the holder had been carried out in an efficient manner. The jury agreed with that belief.

Everyone connected with the Coroner's enquiry, except the gas engineers, seemed to be surprised that the original thickness of the envelope was only 1/10th of an inch. To the Government experts—practical engineers—who were used to the thickness of plates used for oil tanks and in shipbuilding, the fact that the original thickness of the sheet envelope was only 1/10th inch was perhaps rather a shock. They seemed to be astounded at the discovery that a minimum thickness of 1/40th inch thick had been discovered on the plates that had been separated from the holder.

The holder was designed, as were all holders at the date of the failure in Hongkong, on the assumption that its safe working life was 40 years; but it failed after 26 years in use. The designers assumed that the only forces to be considered were (*a*) the wind pressure on the windward side (*b*) the small gas pressure inside the holder.

Concerning (*a*) there can be no doubt that the failure was on the leeward side of the holder and that, therefore, the wind pressure force considered by the designer had nothing to do with the failure.

Even if the gas pressure inside the holder had been as high as ½ lb. per square inch —which it was not— and if we take the fracturing tensile strength of the envelope sheets at a low yield point figure of 16 tons per square inch, then the material would just about begin to fail when it was corroded to 1/120th of an inch thick. If, however, the suction effect on the leeward side were sufficient to make the difference in pressure on the inside and outside of the holder 1½ lb. per square inch, then a plate 1/40th inch thick would just about fail at that difference of pressure.

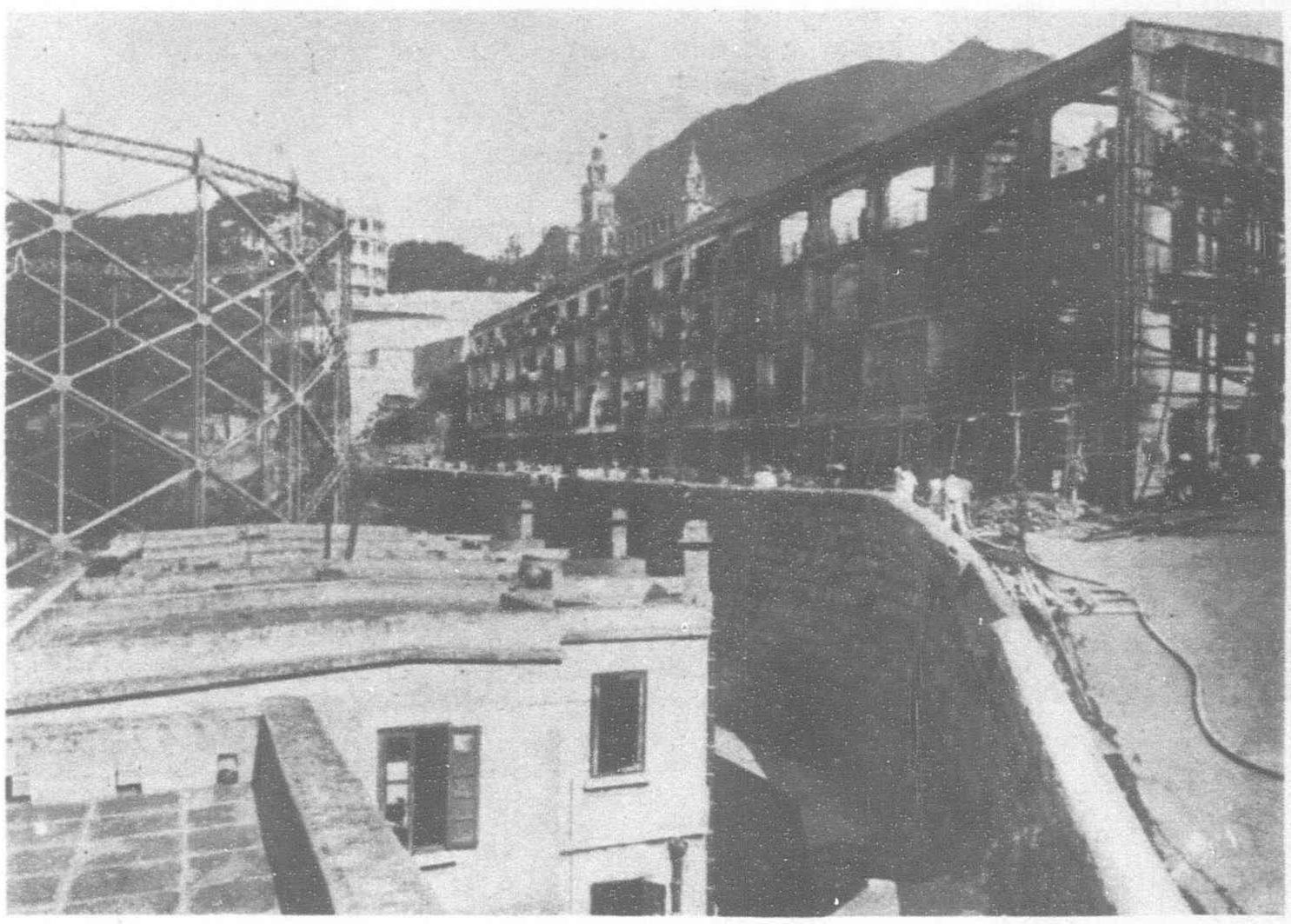
One expert, in discussion, at first refused to believe the statement that 1/80th inch thickness of plate was sufficient to withstand the small pressure of gas in the envelope, although after argument, he was persuaded that it was sufficient to withstand the gas pressure only. To give the jury some idea of the stiffness of the plates, evidence included the exhibit of an ordinary cigarette tin which is only 1/100th inch in thickness.

Evidence at the Coroner's inquest showed that on the "Northeast side of the holder, which was exposed to the full force of the North East wind, there were relatively few or no patches" It was mentioned that 62 patches were noticeable on the opposite (S.W.) side of the holder—i.e. where the failure took place. Those facts were, from the early stages of the enquiry, most puzzling.

The important facts about the sheeting were (1) a marked, but under normal conditions not dangerous corrosion in the S.W. position of the holder (2) practically no corrosion on the sheets in the N.E. position.

Researches finally led to an unexpected solution of the mystery. It was this. The frequent and at times, high velocity of the E. by N. wind produced, on the leeward side of holder (i.e. the side that failed) a *suction effect*. That is to say, at periods the atmospheric pressure on the leeward side was not, as is always assumed, about 14.7 lb. per square inch. It was much less, with a E. by N. wind of very high velocity. That is to say, the net difference of pressure on plates on the leeward side of the holder was not (as assumed) always just the difference between atmospheric outside and atmospheric, plus gas, pressure on the inside of the holder i.e. less than ½ lb. per square inch. It was, on the contrary, a much greater difference, a difference quite sufficient to cause a collapse of a plate 1/40th inch thick. Especially if, as seems certain, the strength of the plate had been weakened by alternating stresses due to varying suction, or negative, pressure effects over years.

But why were the plates on the S.W. side so much more corroded than those on the N.E. side of the holder? The answer is that the plates on the N.E. side, irrespective of gusts and variable wind, were always pressed inwards and when the wind was E. by N. they scarcely moved. But the plates on the S.W. side had no such support against a to-and-fro (or "panting action"), and as the decrease in atmospheric pressure, or suction effect, continually varied with gusts and velocity of the wind, these plates were (with a N.E. wind of some velocity) always in a state of motion. They were frequently moving outwards when there was a strong wind or gust and, as soon as the wind fell, they more or less resumed their normal position. It was this motion that greatly assisted the corrosion effect and so weakened the plate.



The situation of the gasholder. Towers on the University Main Building are seen in the picture above the houses destroyed by the fire

The Alternating Stresses

It is accepted that, in the course of years, slight corrosion of a holder is inevitable. That is the reason why the life of holder is, in practice, limited to about 40 years.

If the plates on the envelope in Hongkong had not moved in and out in this "panting" action described above, it is unlikely that there would have been any great difference in the corrosion in the S.W. and N.E. positions. But any scale caused by corrosion on the S.W. sides would be flaked off by the "panting action" and that would expose the material more readily to corrosive action.

Flaking off the scale was like removing the scab formed by nature over a cut on one's hand—it interfered with nature's way of protection. And, although both corrosive action, and the effect of varying stresses on steel plates, are still somewhat mysterious, it is certain that the constantly varying stresses did weaken the strength of the plate.

It might, of course, reasonably be asked whether the plates on the N.E. part of the envelope were not also subjected to this "panting" effect due to any suction produced on that side when the wind blew in the S.W. direction.

Observatory records showed that there were strong winds at certain periods of the year in the S.W. direction. They were less frequent than the N.E. winds.

Those S.W. winds, however, had practically no effect upon the holder. The houses that were burnt out on May 14, 1934, had, for years, screened the holder from the S.W. gales. Indeed the holder was screened by the rise in ground level of the hillside and/or by buildings in almost every direction except from the N.E. winds.

When first this idea about the effect of suction on the S.W. side of the holder was suggested, it seemed worthy of close

investigation and local Observatory records were examined. The maximum gusts recorded at the Royal Observatory on the day of the failure of the holder was 36 m.p.h., which, did not create enough suction to tear away a plate of 1/40th inch thickness, if the plate material were of standard tensile strength. There are, however, two points to be noted.

For a period of 34 days before the disaster the wind was E. by N. for 10 days. On three occasions it was slightly above that recorded on May 14, 1934. On August 1, 1931, there was recorded at the Observatory a gust velocity of the wind at the rate of 136 m.p.h. from E.N.E. when a typhoon was within 50 miles S.W. of Hongkong.

Researches on Wind Effects

On March 1, 1934, there had been a wind at the Observatory of 68 m.p.h.—enough to give a considerable suction effect. That wind probably did most of the final damage ; the gust on May 14, was the last straw of the load producing the stress on a badly weakened plate that failed.

The fact that at the Hongkong gas-works a holder, of much smaller dimensions, and much less exposed to winds, had lasted more than 40 years, without any trouble, tends to confirm the above causes of corrosion and failure.

The gust of wind on May 14, was the last straw of the load producing the stress on a badly weakened plate that failed, at the rivet joints.

It is only in recent years, mostly because of aeronautical developments, that experiments have been made with wind tunnels. There is now no doubt that " suction " is a definite and most important fact during a gale. There were other unknowns in the local problem—records of the wind velocities on the holder at any time, and the tensile strength of the plates.

Perhaps the following conclusions are only of consequence where there are very unusual conditions, as in Hongkong. They may be of use as a warning only for places where winds of typhoon force occur, and where the situation of the holder leaves it exposed to the full force of the wind. But they may lead to a change in manufacture and a lengthening of the life of holders in temperate climates. It is significant that there was very little corrosion of plates on the holder in Hongkong on the N.E. sector.

Evidence concerning suction effect is given by Dr. Manfred Curry in a book dealing with the aero-dynamics of sails. Curry writes concerning this suction effect on aeroplane as follows :—

> " The difference in pressure on the two sides of a plane was first suspected by aviators. In fact, it was a great surprise to the pilot who, purposely or involuntarily, having dropped abruptly in his flight, found the upper wing covering of his plane torn into shreds, when he again assumed a horizontal course ; the negative pressure had done this, while the positive pressure had not even pressed in the under covering. Of late this has been taken into account and the covering of the upper surface of a plane is generally given double the strength of that of the under surface."

Curry's experiments show that the suction effect in the lee of a sail has been found to amount to three or four times the positive pressure on its windward surface. He writes : " the yachtsman was confronted with a phenomenon that seemed entirely incredible at first thought..... We, the yachtsmen, sail, properly speaking, not by means of the pressure, which arises from the impact of the wind on the sail, but chiefly by means of the " suck " which acts on the leeward side."

Recent Experiments

Unexpected evidence, confirming the above suggestions made in May, 1934, has recently become available. The following is a precis of a Report on Wind Pressure Experiments on a Scale Model Gasholder (J. Ackeret, *Swiss Monats Bulletin*, 1934, 14 P.218).

" To enable accurate calculations to be made for the design of the new 100,000 c.m. (3,500,000 cft.) gasholder for the Zurich gas-works, the distribution of wind pressure over the surface of the structure was investigated by the aid of a scale model. The model was made to a scale of 1 : 100, and was placed in a wind tunnel, where it was subjected to an air current of 50 m. (165-ft.) per sec. (112½ m.p.h.). Since the greatest wind velocity encountered in Switzerland is about 25 m. (82.5-ft.) per sec. (56 m.p.h.) this gave a safety margin of 50 per cent. The pressure at different points on the surface of the holder was determined and expressed as a fraction of the velocity head of the air current. The results were plotted as curves, from which models of the pressure distribution were made. The results of the experiments are summarized as follows :—

(1) The regions of high pressure are surprisingly small compared with the areas of low pressure or suction.
(2) The greatest pressure corresponds to the velocity head of the wind.
(3) The greatest suction occurs at the sides.
(4) The whole of the side opposite the direction of approach of the wind is under suction.
(5) The whole of the crown of the holder is under strong suction, especially at the point of impact of the wind.
(6) The standards of the guide framing give rise to local disturbances and increase of suction.

It is pointed out that many of these results are unexpected, and have not hitherto been taken into account in designing the framework of holders, the stability of which has been due chiefly to the large factor of safety employed."

The above extract and other data published furnishes ample evidence that the cause of failure in Hongkong was the great suction effect on the leeward side of the holder. Moreover it was stated in the Report quoted above that this suction effect was unexpected. Evidence of any recognized authority on the design of gasholders in Great Britain would establish as a fact that at May, 1934, no gas engineer or directors of a Gas Company could reasonably have foreseen that the holder would fail on account of a suction effect on the leeward side.

What is Town Gas?

Europeans are familiar with the idea of " Town gas," a gaseous combustible and illuminant which is distributed by means of pipes laid under the streets of every considerable town and populous neighborhood in Europe, North America, and in many other parts of the world. Originally called " coal gas " this most useful commodity for many years has everywhere been manufactured and distributed by almost identical methods. The commercial possibilities of so doing was first proved by the success of a London Company, now known as The Gas Light and Coke Company, which began supply more than a century ago.

The reason we now speak of " town gas " instead of " coal gas " is because in the modern methods of manufacture what is known as " water gas " is added to the gas from coal. The " water gas " is obtained by passing steam over red hot coke. In many cases oil is added to enrich the gas.

In the early part of the last century a remarkable working mechanic in England, named Murdoch, hit upon the idea of heating coal in a vessel ; and he discovered that certain volatile gases were then driven out of the coal. He found that when those gases were ignited they provided a useful illuminant. And so, in 1810, an Act of Parliament incorporated " The London and Westminster Chartered Gas Light and Coke Company," as a public service undertaking for the manufacture and supply of town gas. That was after Murdoch had proved the value of his invention by demonstrating it in a few private plants in factories in Birmingham, where he was employed in the steam engine works of James Watt.

Now the creation of a public gas supply undertaking was no easy matter, for it involved many problems of administration and technique for which there was no precedent. The fire insurance companies, the public street lamp-lighters, and even scientific authorities of the period, violently opposed the idea of the pipe distribution of inflammable gas. The famous Royal Society, which includes in its limited membership only the most famous scientists, advised the Government to compel the company to restrict the capacity of their gasholders to a volume not exceeding 6,000 cubic feet of gas and to enclose holders in strong brick buildings. A political agitation was organized to defend an industry which was thought to be endangered by the new method of procuring artificial lights in place of oil lamps.

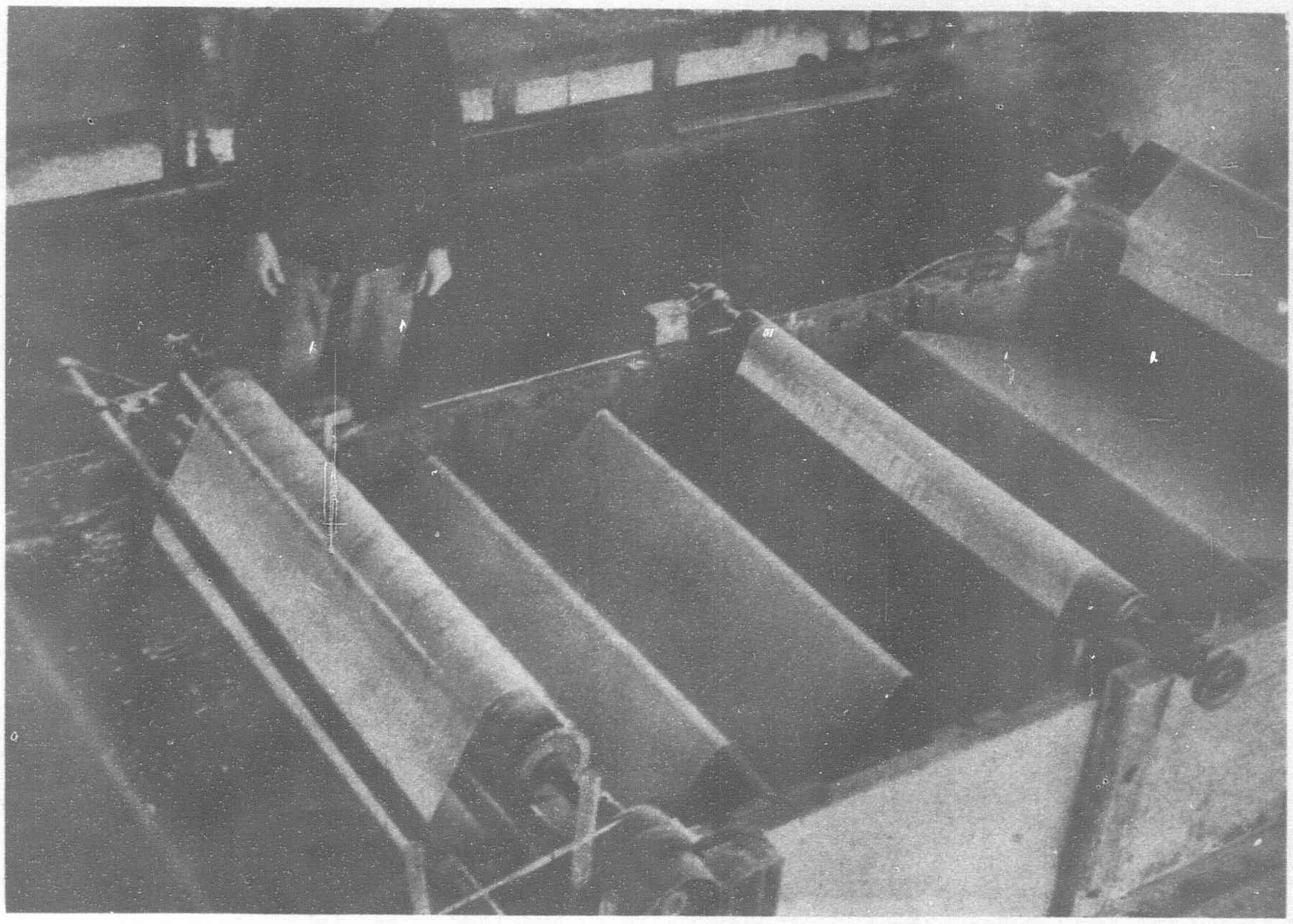
The great Humphrey Davy sneeringly asked whether it was intended to take the dome of St. Paul's for a gasholder.

Work Will Win

Yet those external difficulties were as nothing compared to the internal—technical and financial—of the enterprising promoters.

(Continued on page 272)

Japan's Cellophane Industry



Cotton, dipped in Viscose Solution, solidifies a transparent sheet which, after drying, represents cellophane

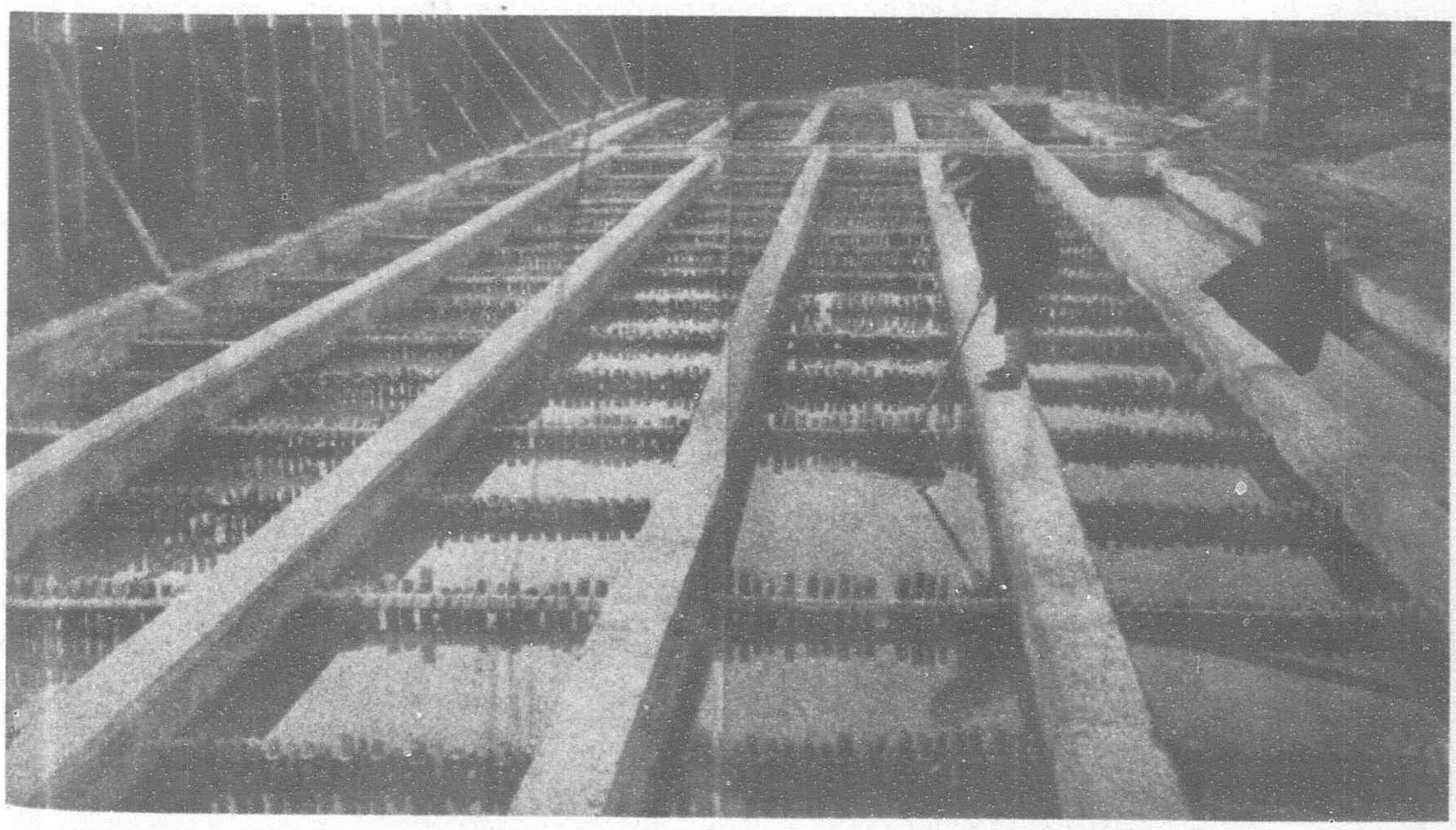
It has been less than 15 years since the Cellophane Industry was initiated in Japan, but the advance of the industry has been quite remarkable. This is due to a great extent to the marvellous progress which has been made in technique. Cellophane manufactured in Japan, which was formerly principally exported to England and other European countries, is now filling the demand of practically all countries of the world, but this is only a matter of the past six or seven years. The direct cause that has brought the prosperity of the cellophane industry in Japan to its present state can be ascribed, as with other industries, to the earthquake and disaster in 1923. Prior to that time paraffine paper was widely used for wrapping in the markets of Japan. But ever since the first manufacture of cellophane, which is transparent and strong and which at the same time does not permit air or dust to penetrate, paraffin paper has been losing its popularity.

It is not long since this French invention was introduced to the Japanese public. "Cello" means fiber and "phane" glass. It was in 1908 that a transparent paper bearing the trade-mark "cellophane" registered with various governments of the world, was first placed on the market by a French firm bearing the same name. As the name is protected in foreign countries, save in Japan where the term of the trade-mark registration has expired, the product has different designations in the different world markets. It is called for instance "viscocell" in Britain; "Heriozell" in Germany, and "Zellglas" in the Netherlands. Even in Japan, the export product is called gelatine paper or transparent paper. The goods made by the Dai-Nippon Celluloid Co., are specially trade-marked "Cellsy" and the goods made by the Fuji Glyphane factory are known as "Glyphane."

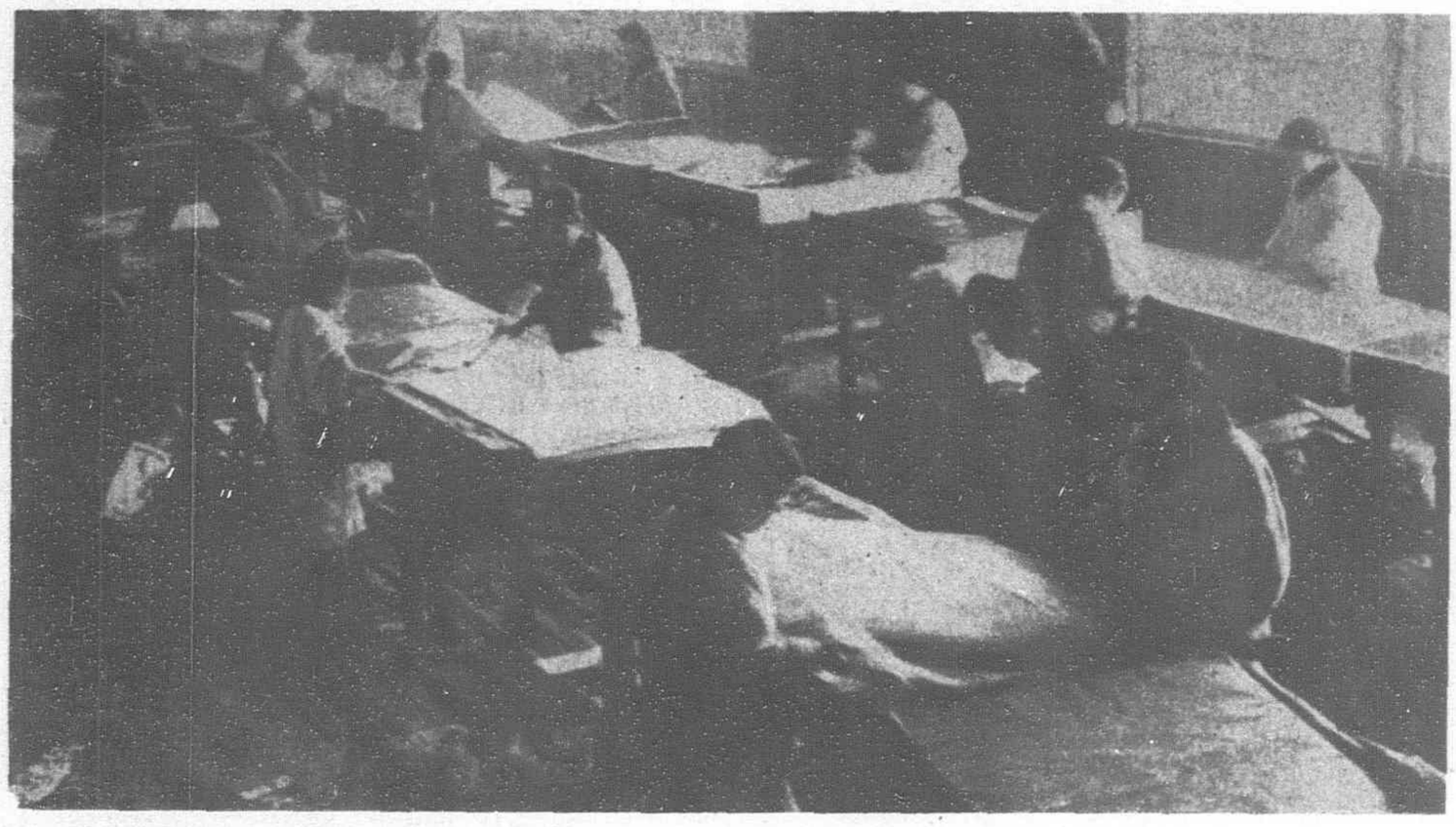
J. E. Brandenberger, the French inventor of cellophane, failed in an experiment to give luster to cotton yarn by treating it with a viscose solution. When dipped in the solution, the cotton thread became stiff and unusable. Though the failure was the beginning of cellophane. The French chemist found that the viscose solution rubbed on the cotton thread solidified into a transparent sheet. Further experiments led to the invention of the continuous viscose patented by the French government in 1909, but industrial exploitation or cellophane production as an industrial enterprise was started only in 1913. Since then Britain, the United States, and Germany have become cellophane-minded, though the industry was practically monopolized by France before 1923.

Thus Cellophane, the star product of modern chemical industry, has a history of less than 30 years behind it. It is only natural, then, that Japan, the youngest champion in the arena of world trade has started to follow the older powers in this field of activity; and her rising export trade with this product brings to mind that she has successfully imitated and even surpassed her seniors in the technique of manufacture, as shown by the recent perfection of the waterproofing method used in cellophane manufacture.

It was in 1922 that prominence was given by Japanese newspapers to the story of a Japanese tourist who returned from France with transparent paper as a souvenir. The cellophane products imported from France were placed on the Japanese market in the following year and again the next year, 1924, saw a total cellophane import of 6,600 tons in quantity and Y.30,000 in value. The imports increased to 45,400 tons valued at Y.209,000 in 1929 and to 55,800 tons valued at Y.196,000 in the following year.



Drainage and Purification System, to prevent the outflow of chemical liquids to the fields, during the production of Cellophane



Packing of the ready Cellophane sheets in one of the Tokyo Factories

Calcined Soda Tank for mixing the chemical composition

But the world market did not have to wait long for the Japan-made cellophane, which was placed on the market as early as 1925, manufactured by the Korensha, later called the Tokyo Cellophane Company. These early products were called artificial silk paper or glass paper by the Japanese manufacturers. Following parallel progress in the artificial silk industry and in viscose production, many Japanese manufacturers began to enter the cellophane industry. As is the case in every new line, some of them—not a small number—failed, while others pressed ahead. The cellophane industry in Japan has had many ups and downs in its short history of ten years. With cellophane importers in the earlier days making easy money, many industrialists vied with each other in entering the attractive new industry. This, however, resulted in overproduction and subsequently in keen competition among the Japanese manufacturers, which devoured their profits. To remedy the situation, an association was formed in 1933 for the control of the cellophane industry by nine principal concerns.

The association proved not strong enough to defend its price agreement against underselling by outsiders, the number of which greatly increased with new establishments. The first control body disappeared without having achieved any satisfactory results. A new body for the discussion of cellophane problems was organized in February last year.

There are at present 13 firms which are producing cellophane and their combined productive capacity exceeds 35,000 reams a month. These firms are not operated on a large scale. Capitalization does exceed Y.3,000,000 and a monthly capacity of 10,000 reams in the largest of all. The plight prevailing in the industry has led producers to merge and effect economy of production and marketing methods. Some firms have been absorbed by bigger ones, while some others are going to surrender their plants to the more powerful concerns. So far the control body of the cellophane producers has been successful in achieving the above measures, but still there are many who predict that the Japanese cellophane industry will never get out of its hardship unless about one-half of the existing plants are amalgamated with the better established concerns.

These internal difficulties, fortunately enough had no effect at all on the monthly increasing output, as well as doing no harm at all to the Japanese cellophane export trade. On the contrary, international engineering attention is being focussed on the extraordinary and numerous improvements which Japanese chemical engineers have been able to achieve in the quality and adaptability to many uses of cellophane. In order to fully appreciate this, it is interesting to outline various uses of cellophane.

In the manufacturing process, cellophane and artificial silk yarn are the offspring of viscose, a gluey solution made of finer pulp treated with caustic soda, carbon disulphid, and a diluted solution of alkali. When made into thread, viscose is called rayon yarn, while the same material made into thin sheets is called cellophane. Every factory, however, maintains strict secrecy about its particular process and allows no visitors to inspect the plant. The characteristic feature of cellophane is, of course, its transparency. It is easily penetrated by the ultra-violet ray, which ordinary glass does not permit. It may be added in this connection that waterproof cellophane, comparable to the American Dupont product, considered the highest quality in the world, has been produced by a Japanese manufacturer.

Though penetrated easily by various rays, cellophane is proof against water and oil. It is also bacteria-proof and it has a strong resisting power against gas. A cellophane-made shelter against poison gas was an outstanding

(Continued on page 272)

A household making use of a Cellophane shelter during a Poison Gas "Attack"

Mineral Resources of the U.S.S.R.

By V. MARKOV, Geological Research Worker of the Academy of Science of the U.S.S.R. in "The Mining Journal"

THE intensive and orderly development of applied geology in the U.S.S.R. is indissolubly connected with the first Five-Year Plan. Up to 1927, the attention of the country had been devoted principally to the liquidation of the after effects of the world war and the civil war. This was the period known as the Restoration period.

During the First Five-Year Plan, in the Reconstruction period, the question of mineral raw material became extremely pressing in connection with the work for the industrial and agricultural development of the U.S.S.R. To understand the reason for this, it must be remembered that the mining industry was very poorly developed in pre-revolutionary Russia, and the requirements of the country in respect to minerals were met mainly by imports. In this connection, not only was the geology of the country and its mineral resources studied to an absolutely inadequate degree, but there were extremely few specialists working in the mining industry, especially geologists. It is, therefore, natural that the first steps in the direction of providing minerals for the requirements of national economy were the training of suitable people as geologists. A number of new special geological surveying institutes were added to the existing system of universities and colleges. At the same time, a number of high schools were opened to educate technicians for geological survey work, and a large number of courses were founded for preparing the lower technical personnel (drilling workers, collectors, etc.).

As all geological surveying work was concentrated in the hands of the government, the necessary material supplies and personnel were assured and were utilized in the best possible manner.

The number of geological surveying parties grew from 266 in 1926 to 2,563 in 1932. During the same period, the number of workers engaged in geological surveying work increased from 8,000 to 75,000. The number of engineers and technicians rose from 1,500 to 8,500. Government expenditure on geological research work, which had been about 14,000,000 roubles in 1928, rose to 200,000,000 by 1932. In subsequent years, the capital invested in geological surveying work in the U.S.S.R. was about 500,000,000 roubles a year.

What are the general results of geological surveying work in the U.S.S.R. at the present time ? Let us examine, first of all, the question of the preparation of geological maps.

The following table shows the growth in the areas which have been geologically surveyed for the preparation of maps (the total area of the U.S.S.R. is 21.3 million square kilometers).

Scale	*Area Mapped (Sq. Kilometers)*	*Per cent. of total area of U.S.S.R.*
(*On January 1, 1918*)		
Total on all scales	2,208,900	10.4
Scale 1/200,000	51,800	0.25
Scale 1/100,000 and bigger	92,600	0.45
(*For the period 1918-1929*)		
Total on all scales	3,823,650	18.0
Scale 1/200,000	241,800	1.1
Scale 1/100,000 and bigger	217,700	1.0
(*On January 1, 1937*) (*incomplete figures*)		
Total on all scales	9,170,200	43.2
Scale 1/200,000	1,816,800	8.5
Scale 1/100,000 and bigger	897,100	4.2

Thus, during the Soviet period, one-third of the total territory of the U.S.S.R. has been geologically surveyed and mapped, whereas before the revolution only one-tenth had been surveyed.

Parallel with the preparation of geological maps, a study is being made of the useful mineral raw materials under the surface of the U.S.S.R. In the first years, special attention was paid to providing national economy with mineral fuels and raw materials for the rapidly developing iron and steel industry and the non-ferrous metal industry.

Oil

The output of oil in Russia, before the revolution, reached its highest level in 1901, when 11,668,000 tons were obtained.

The civil war and foreign intervention cut the chief oil-fields off from the Soviet Union for a long time, and afterwards the Soviet Government received these districts in a dilapidated condition. Only in 1927, was it possible to reach an output of 10,285,000 tons. Subsequently the output of oil in the U.S.S.R. was as follows (in tons) :—

1928 ..	11,625,400	1931 ..	22,391,900	1934 ..	24,195,900
1929 ..	13,684,400	1932 ..	21,413,200	1935 ..	25,135,700
1930 ..	18,450,800	1933 ..	21,481,400	1936 ..	27,337,700

Such an increase in output could naturally not be obtained from the previously known areas. In addition to a careful survey of the old oilfields (Baku, Grozny), which proved a considerable increase in their supplies of oil, a number of other oilfields, either entirely new or previously ignored, were opened and developed.

The total deposits of oil in the U.S.S.R. in 1937, are estimated at 3,208 million tons, of which 530 million tons are in active oilfields and are beyond all doubt. The re-calculation of oil reserves that is being made for the 17th International Geological Congress, which will take place in Moscow in July, 1937, shows that the figures given above are not complete and that the oil deposits are considerably greater. At the present time the U.S.S.R. takes second place in the world, after the U.S.A., in its oil reserves. Among the newly opened and surveyed oil districts, mention should be made of Bashkiria and the Kama District, of the Urals, which are of the greatest importance for national economy. Prospecting in recent years has shown good signs of oil in the district to the north of the Aral Sea and in the Far East in the district of the Aldan Range. New oil districts have been discovered in the north of the U.S.S.R. in the Ukhto-Pechera district and on Nordwick Peninsula. Not long ago oil was discovered in the vicinity of Syzran on the Volga.

Coal

The total amount of coal in the coalbeds of pre-revolutionary Russia, was estimated at 220,925 million tons. At the present time these estimates exceed 1,200,000 million tons. This increase is the direct result of energetic prospecting work, which has discovered new rich coal districts and coalfields, such as the Pechora coalfields with 60,000 million tons of coal, the Karaganda coalfield with 50,000 million tons, the Berein coalfield with 60,000 million tons, the Kana coalfield with 40,000 million tons, and the huge Tungus coal area with seams containing as much as 300,000 million tons of coal.

At the same time the study and survey of the old coalfields is continually bringing to light more and more wealth in them. Thus, the coal in the Kuznets coalfield, which reckoned at 13,000 million tons in 1913, is now estimated to reach 400,000 million tons. In the same period the reserves of the Kizelov coalfield grew from 72 million tons to 2,504 million tons. The estimated reserves of the famous Donetz coalfield have risen from 55,000 millions to 71,000 millions, and, moreover, this increase is entirely on the old area of this coalfield. The work of the last few years has demonstrated that the coal-bearing seams spread considerably beyond the limits of the old Donetz coalfield, which will undoubtedly add new thousands of millions of tons of coal to the estimated reserves. These results of geological prospecting work have ensured a steady growth in the quantity of coal mined, which was as follows (in thousand tons) : 1913, 29,117 ; 1928, 35,510 ; 1930, 47,780 ; 1934, 93,940 ; 1935, 109,900.

It is interesting to examine some other figures on the development of the coal industry in the U.S.S.R.

The total number of mines in operation was as follows : in 1932, 441 ; in 1933, 479 ; in 1934, 502.

The following table shows the changes in the capacity of output of the mines :—

Capacity	Number of Mines 1932	1933	1934
20,000 to 50,000 tons	92	79	68
50,100 to 100,000 tons	124	145	138
100,100 to 200,000 tons	131	135	141
200,100 to 500,000 tons	82	102	127
Over 500,000 tons..	12	18	28

The mechanization of the output of coal, which was insignificant in pre-revolutionary Russia, is developing with extreme rapidity:

Type of machine	Number of machines at beginning of year 1929	1930	1931	1932	1933	1934	1935
Heavy coal cutting machines	549	761	1,007	1,278	1,473	1,679	1,754
Light coal cutting machines .	268	393	409	322	339	294	327
Pneumatic drills	71	1,274	3,322	6,190	9,020	10,764	12,931

The ratio of hard coal to cannel in the total reserves of coal of the U.S.S.R. is very advantageous. Hard coal forms 83.4 per cent of the total and cannel coal only 16.6 per cent.

Considerable interest attaches to the changes in the districts where coal mining has been carried on in the U.S.S.R., since the revolution. The changes are shown in the following table :—

	Total coal output		Donetz Coalfield		Urals		Coal output of Individual Districts West Siberia		Kazakhstan		Moscow Coalfield		Other districts	
	Thous: tons	Per cent of 1913	Thous. of tons	%of total output of U.S.S.R.	Thous. tons	%of total output of U.S.S.R.	Thous. tons	%of total output of U.S.S.R.	Thous. tons	%of total output of U.S.S.R.	Thous. tons	%of total output of U.S.S.R.	Thous. tons	%of total output of U.S.S.R.
1913 . ..	29,117	100	25,288	86.8	1,217	4.1	799	2.8	90	0.3	300	1.0	1,423	5.0
1928 . ..	35,510	121.9	27,330	77.0	1,989	5.5	2,743	8.0	23	0.07	1,135	3.2	2,313	6.3
1932 . ..	64,664	222.0	45,044	69.7	3,166	5.0	7,544	11.5	822	1.4	2,613	4.0	5,475	8.4
1934 . ..	93,940	322.6	61,496	65.5	5,508	5.9	11,974	12.7	1,919	2.0	4,619	4.9	8,451	9.0

This table shows how, along with a steady growth in the output of coal from all districts, the relative importance of the old districts becomes less, owing to the increased output from the new coalfields. Among the "other districts" mentioned in the table, attention should be paid to the eastern districts. The coal output from the coalfields of Eastern Siberia, which amounted to 822,000 tons in 1913, had reached 3,522,000 tons in 1934, i.e., it had more than quadrupled. The coal output of the Far Eastern Region rose from 297,000 tons in 1913 to 2,747,000 tons in 1934, i.e., over nine times.

Iron Ore

The total quantity of iron ore known in the territory of the U.S.S.R. in various years was as follows : 1913, 2,000 million tons ; 1927, 3,442 million tons ; 1933, 9,042 million tons ; 1936, 10,778 million tons.

The increase resulted both from a more detailed study of the old ironfields and from the discovery of new ones.

During the last ten years, the known reserves of various ironfields have increased as follows : Krivoy Rog from 458.4 million tons to 1,455.2 million tons ; Kerch (Crimea) from 1,978.4 million tons to 2,724.4 million tons ; Ural ironfield from 750.6 million tons to 1,467.2 million tons, etc.

New ironfields have been discovered and more or less surveyed. They are the Kursk Magnetic Anomaly with 340 million tons ; the iron fields on the Kola Peninsula with an aggregate quantity of 1,356 million tons ; the Telbes and Kondom group of iron seams in West Siberia (Shoria Highlands) with 120 million tons ; the group of seams of iron ore in Krasnoyarsk Region with 260 million tons, the Angara-Ilim iron ore district in East Siberia with about 370 million tons ; the Malo Hingan district in the Far Eastern Region with about 330 million tons, and a number of others.

Besides the seams of rich ores in the U.S.S.R., iron quartzites have been discovered to the extent of 255,000 million tons and a technological process has been worked out for extracting iron from them. These increases in the known reserves of iron ore have made it possible to considerably increase the quantities mined and to develop the iron and steel industry.

	Mining of Iron Ore	Iron Smelted
1913	9,214,000	4,216,000
1928	6,124,000	3,282,000
1929	7,983,000	4,022,000
1930	10,654,000	4,964,000
1931	10,587,000	4,876,000
1932	12,076,000	6,177,000
1933	14,562,000	7,131,000
1934	21,631,000	10,428,000
1935	27,062,000	12,493,000
1936	28,200,000	14,500,000

The reconstruction of the iron and steel industry in the U.S.S.R., is characterized in general by the following figures :

	No. of Blast Furnaces	Total working volume (thous. cubic meters)	Average volume (Cubic meters)
On January 1, 1928 ..	69	20.0	290.3
,, ,, 1933 . ..	103	36.9	358.4
,, ,, 1934 . ..	108	42.2	390.9
,, ,, 1935 . ..	112	48.4	432.1
,, ,, 1936 . ..	118	51.9	439.8

Manganese Ores

The known quantities of manganese ore in the U.S.S.R., have increased from 167.9 million tons in 1913 to 709.4 million tons in 1936. To the well-known seams of Nikopol (Ukraine) and Chiatura (Georgia) have been added seams in the Urals, in West Siberia and Kazakhstan.

Copper

The quantity of copper ores, known in the U.S.S.R., calculated in metal content, was estimated in 1913 at 627,000 tons. In 1936 this quantity had grown to 17,072,500 tons. The increase is the result of the discovery of big new beds of porphyry ore at Kaunrad in Kazakhstan with 2,455,000 tons of copper, and the Almalyk beds in Uzbekistan, containing about 3,000,000 tons of metal. In addition, a number of beds of copper pyrites have been discovered, among which mention should be made of the Bliavin beds in Orenburg Region, which contain about 323,000 tons of metal. A detailed survey of copper bearing sands in Jezkazgan (Kazakhstan) has fixed the quantity of copper in this rich copper field at 3,078,000 tons. The known quantities of copper in the Ural deposits increased between 1929 and 1935 from 451,000 tons to 1,960,000 tons.

The amount of copper ore mined in the U.S.S.R. is as follows (in thousands of tons) :—

1913	721.0	1928.. ..	640.7	1934.. ..	2,084.2
1922	14.5	1931.. ..	1,106.1	1935.. ..	2,790.5
1923	60.1	1932.. ..	1,187.2	1936.. ..	3,689.0
1927	492.5	1933.. ..	1,332.8	(prelim. figs)	

Zinc and Lead

The quantity of lead and zinc ores, known in the U.S.S.R., has increased as follows (in thousand tons of metal content) :

	1913	1927	1933	1935
Zinc	1,100	1,017	7,847	9,932
Lead	500	698	4,019	4,124

Space does not permit us to give, even in the briefest form, an account of all the varied kinds of non-metallic useful minerals, and we are thus compelled to restrict ourselves merely to a characterization of the group of agricultural ores, which includes potash and phosphoric salts, serving for the manufacture of mineral fertilizers.

Apatite

No industrial deposits of apatite were known in pre-revolutionary Russia. Prospecting in the Kola Peninsula, mainly in the first Five-Year Plan, brought to light huge deposits of apatite at Hibini containing about 2,000 million tons of apatite ore.

The discovery of this ore made it possible to rapidly organize and develop the mining of apatite, both for home consumption and for export. The quantities of apatite mined in the U.S.S.R. (in tons) was as follows :—

	Ore	Concentrates
1929	2,000	—
1930	265,700	—
1931	573,200	26,900
1932	380,200	156,500
1933	686,800	213,400
1934	1,136,200	382,800
1935	1,533,300	770,000
1936 (plan)	2,000,000	920,000

Phosphorites

The amount of phosphorites known in pre-revolutionary Russia (1914), was 5,500,000 tons. By 1936, as the result of the discovery and survey of a large number of big deposits, this figure had risen to 16,813,900,000 tons.

Potash Salts

Potash deposits were discovered in the U.S.S.R. in industrial quantities at the beginning of the '20s of the present century. In 1925, surveying work began on the Solikama deposits (upper Kama district), which proved to be the biggest in the world. At the present time, the reserves there are estimated at 18,639 million tons of potassium oxide (K_2O). The work of the Academy of Science in recent years has brought to light new big deposits in western Kazakhstan.

The mining of potash in the U.S.S.R. began in 1931-32, and was as follows (reckoned in content of K_2O) :—

1931-32	191,000	tons
1933	303,000	,,
1934	1,001,000	,,
1935	1,319,000	,,
1936	1,800,000	,, (plan)

Borax

Energetic searches for deposits of borax in the U.S.S.R. for a number of years were only successful in 1934, when rich beds of borates were discovered in the district of Lake Inder in Western Kazakhstan. At the present time, although the surveying work is not completed, the quantities are estimated at over 180,000 tons, calculated in pure B_2O_3.

Attention Paid to Organization

The geological work performed in the U.S.S.R., shows that the Soviet Union contains in industrial quantities all types of mineral raw material used in industry. This success, which was obtained in the course of only about 10 to 12 years, is explained by the tremendous attention paid by the Soviet government to the question of the basis of mineral raw material for national economy. The question of the geological study of the U.S.S.R. and the organization of geological services, has been the subject of discussion in government organs on repeated occasions. At a very recent date, on February 16, 1937, the Council of People's Commissars of the U.S.S.R. adopted a very important decision on the organization of an All-Union Geological Fund, in which will be concentrated all materials on all geological work in the territory of the U.S.S.R. for combined generalization. The formation of such an institution, in addition to its tremendous practical importance, is of considerable scientific interest, opening up before research workers the possibility of utilizing in their work all the accumulated experience and knowledge in their special spheres of interest.

Within a short period, a wide system of scientific research institutes was formed in the U.S.S.R., working both in the sphere of method and technique of geological surveying work, and in the domain of theoretical geology. Besides a series of Institutes of the Academy of Science, scientific research institutes have been organized in the system of Soviet industry. There is the Central Scientific Research Geological Survey Institute, the Scientific Research Institute for Gold, for Oil, for Nonferrous and Rare Metals, the All Union Institute for Mineral Raw Material—this is, by no means, a complete list of these organizations, which, together with their branches in the localities, cover the territory of the Soviet Union in a dense network, combining theory and practice in their activity by means of direct and constant contacts with the practical work of the preparation of geological maps, the surveying and operation of deposits of useful minerals.

* * *

The Colossus of the North

With reference to the foregoing article, extended editorial comment of *The Mining Journal* is of special interest. This follows :—

" From time to time, especially at the moment in relation to gold shipments, we get reminders of the great strides which the mining and metallurgical industry is making in Russia. For the most part, however, the old saying is true, " out of sight out of mind," and our complacency is apt to receive a somewhat rude jolt when some particular development brings about a realization, both of the immense scale and of the energy with which the U.S.S.R. Government is at work on the development of its natural resources.

" This week we publish an extremely interesting study of the development of the mineral resources of the United Socialist Soviets of Russia, which constitutes a fine prelude to the International Geological Congress in Moscow.

" The order in which Russia has attacked her mineral development program is logical. First a geological survey and mapping, next concentration on fuel resources, then on iron deposits, and next on base metals. These, however, are only the broad outlines, Mr. Markov says nothing regarding the possibilities of the more specialized base metals—nickel, quicksilver, and so on, regarding which isolated items of information reach us from time to time. The most noticeable omission of all, is the absence of reference to gold and other precious metal mining, the success of which is the cause of much anxiety in the Western world to-day. This silence is in line with the reserve with which information as to the progress of the gold industry has been treated by the Soviet Government in recent years, but it may be due not so much to deliberate reticence as to the close association of the precious metals industry with the Department of Finance, which we believe existed, at any rate, up to a recent date, necessitating data as regards precious metal mining being derived from separate sources.

"Viewed very broadly, Russia offers to-day the most interesting sphere of mining activity afforded anywhere in the world. The immense figures of reserves of mineral resources of all kinds which Mr. Markov presents are very largely additional to any present computations of the mineral resources, generally available, in these days of unrivalled growth of industry, and consequently demand for metals and ores of various kinds. Russia has, from the point of view of mineral development, until the beginning of the Five-Year Plan, almost stood still while other countries have been making their unexampled progress. A year a two before the Great War, it was beginning to be realized in farseeing circles in Russia that they were on the verge of industrial development likely to outpace anything which had been witnessed in the United States and Canada in the 19th century. Russia, which was almost mediæval in her communications and standards of living over the great bulk of her enormous territory, seemed likely to become modernized and industrialized with a rapidity of which there had been no previous experience. The war, and then the revolutions came, and the movement was arrested for nearly twenty years. In the meantime industrial planning had made vast strides in America, enabling a new technique of mass production to be improvized under a centralized administration, hampered by no political or competitive restraint.

" Some of the results are startlingly indicated in Mr. Markov's summary. Significant of this arrest and subsequent stimulation of industry, are the figures quoted for the oil industry, showing that the output of 1901 was not surpassed until 1929, since which date production has rather more than doubled. Outstanding, perhaps, in the picture is the knowledge that has been acquired of the petroliferous resources of the Soviet Confederacy. We have no means of knowing how much detailed knowledge is implicit in the estimate of a total reserve of 3,208 million tons of oil which it is suggested will be considerably increased when the final figures are available at the Moscow Conference. But even the figure of 530 million tons in fields at present under exploitation represents, on the usual allowance of seven American barrels to the ton, a total of 3,610 million barrels of crude. With a Russian production which this year may reach 200 million barrels, we have indicated 18 years supply at current rates of production as compared with, say, 13 or 14 years of definitely proved reserves in the United States. In both cases, no doubt, computations of reserves will go on growing as they have done in past years, but quite obviously the purely virgin territory in the U.S.S.R. is much more extensive than in the U.S.A.

" The expansion in the Russian coal industry also is probably hardly realized in this country, and obviously it can only be a question of demand which can prevent Russia soon surpassing Germany in th eproduction of hard coal, and becoming the third coal producing country of the world. The available coal reserves of the United Kingdom were estimated by Prof. H. S. Jevous, in 1915, to a depth of 4,000 feet at 168,000 million tons, since when we are not aware

of any fresh survey having been attempted. As against this, the Russian coal reserve is currently estimated at 1,200,000 million tons. The Imperial Mineral Resources Bureau's report on the iron ore resources of the world, showed developed reserves in the U.K. of some 1,200 million tons, and a probable total quantity of, perhaps, three times this amount, but the bulk of these reserves is low grade ore. The estimate of iron ore for the U.S.S.R. is placed at 10,778 million tons. It is only in keeping with the magnitude of these resources, and the immense demand for constructional material in Russia to-day, that the output of pig iron, last year, should have reached 14,500,000 tons as compared with 7,685,700 tons for the U.K. It is a similar story with regard to manganese, though here Russia has usually been the largest producing country. The present estimate of reserves is 709½ million tons which, on a production basis of about 2,500,000 tons per year in 1936, represents an almost inexhaustible reserve, if the term manganese ore is used in the sense understood in this country. Russia is currently supposed not to be too abundantly supplied with copper, but the estimate of a total metallic content of the ores located of over 17,000,000 tons puts a very different complexion on the picture. We may compare this with the estimate given by Messrs. Parker and Gray, of the amount of ore developed in the Rhodesian copper belt of 551.7 millions tons of 4.11 per cent ore, which would represent 22,619,905 tons of metal contained in the ore.

"It is unnecessary to carry comparisons further, the foregoing instances being sufficient to show Russia, in future days, as not only being amply self sufficing in mineral reserves, but possessing resources which should render her a very large contributor to the rest of the world, either in the form of metal or metal manufactures. Under current conditions, of course, transport charges from the more remote districts seem to qualify this view, but on a long prospect, providing that the figures put forward in the article are not too sanguine, apprehensions of possible growing world scarcity of mineral supplies are greatly lessened.

"Moreover, Russia is largely free, and likely to remain so for a considerable period, from the industrial anxieties which harass capitalist countries at the present time. The Soviet Government says to its citizen 'do this and he doeth it.' A strong centralized Government can, with the enormous and rapidly growing Russian population, find abundant supplies of raw labor for any particular class of work in any locality, as its industrial plans may require. Consequently whether we regard the position from the point of view of natural resources or of man power, the immense economic strength of the position is apparent. These considerations help us to appreciate the sincerity of the constant Russian assertion that they have no national policy except world peace. They have nothing to covet in the territory of other nations, and their desire is to make the best use of their natural resources for the employment of which their own country affords such an important field."

The Maintenance of Steel Structures in the Far East Corrosion and Typhoons

(Continued from page 266)

But a certain Mr. Clegg (the savior of the industry in those early days), fought with true British bull-dog tenacity for his convictions. And before he died, in 1861, gasholders of 200-ft. diameter has been built, whereas the diameter of the dome of St. Paul's is only 145-ft. Incidentally it may be mentioned that the gasholder at West Point was about 94-ft. in diameter. And in all the 120 years of the use of these metal envelopes for storing gas there have been very few failures—none due to causes which caused the failure in Hongkong.

Metal piping was not obtainable in the early days of the industry, and the first gas company made shift with old musket barrels screwed together. Mains were actually made of stone. There were no meters and there were no dividends. But Clegg, the quiet, indomitable and strong man, persevered; and he lived to see the sooty, tarry bantling, which he had nursed through its infantile ailments, grow into a giant whose labors returned most valuable profits to his employers.

To-day the town gas industry in Britain has reached enormous proportions. Millions of householders use "penny-in-the-slot" meters. Millions upon millions of cubic feet of town gas are used in metallurgical and other industrial processes. The incandescent mantle gives out about twenty times as much light for a cubic foot of gas as its predecessor, the bat's-wing burner, which was common use in the memory of elderly people.

In recent years, the great increase in the production of town gas in Britain, has been due to the fact that it is a fuel, cleanly and inoffensive, which can be obtained by turning on a tap. It will grill a chop, boil a kettle, melt a crucible charged with platinum, warm a house, drive an engine—and is a practical cure for the smoke nuisance in towns.

How Gas Burns

Town gas requires about 5½ times it volume of air for complete combustion. It may consist of about two-thirds coal—gas and one-third carburetted water gas, by volume. About ninety-three per cent of town gas consists of combustible and illuminants, the remainder being inert gases. And it is the carbon and the hydrogen in the town gas that, when mixed with the oxygen in the air, and ignited, gives out the heat.

From the earliest days of the industry the Legislature in Britain has taken an active part in safeguarding the interest of the general public. It was quickly realized that with this public utility, as with many others, competition is not always the method of providing town gas to the best advantage of all parties concerned. In some towns the gas supply was undertaken by the local authority, as in Birmingham. In other cases the gas companies have shown themselves most progressive and valuable servants of the community.

In May, 1934, the general public in Hongkong was, naturally enough, alarmed because of the terrible catastrophe at West Point. It may be small consolation to be reminded that accidents will happen in spite of all precautions that are taken. When we remember the enormous quantity of this inflammable gas that is supplied all over the world, it is amazing that we so seldom hear of trouble. Compare the accidents with those that take place on railways, on road transport, in flying, at sea, or by the ordinary accidental burning of buildings.

Japan's Cellophane Industry

(Continued from page 268)

feature of recent air defence manœuvers held in the Osaka-Kobe district by the Japanese army. There are also experiments being made to use cellophane in making gas-masks, and in connection with many medical and chemical instruments, as progress goes on in the field of scientific study. Cellophane lends itself to dyeing and printing. It is not only highly insulating, but is also unaffected by volatile solutions, such as alcohol, ether, and benzine. Unlike celluloid, it has a high flashing point. In addition, cellophane has a solid durability.

Consequently, the product has almost unlimited uses. Besides those mentioned above, costumes for stage dancers, umbrellas, wall paper, insulators, lamp shades, handbags, toys, and airplane wings are included among the cellophane manufactures. And the number of uses will grow year by year, as cellophane is the product of a young industry now making rapid progress.

A cellophane mixture with artificial silk or hemp braid, having been made possible in recent years, enjoys a brisk demand in all countries. Moreover, the Japanese manufacturers have begun producing a cellophane fiber by cutting the cellophane thread into small pieces, one thing amongst other things, which cellophane chemists in other countries failed to think of. Among them, one of the most up-to-date inventions is as a substitute for photographic films. Cellophane is also employed in recording talkies.

With these improved facilities, Japanese cellophane is bound to occupy a supreme place on the world market in the immediate future. About two-thirds of the total production has been exported to foreign markets during recent years. Though the Japanese manufacture registers only a minor figure of the world output, the depreciated yen, low production costs and supreme quality are advantages for Japanese cellophane among international buyers.

A Notable Demag Installation

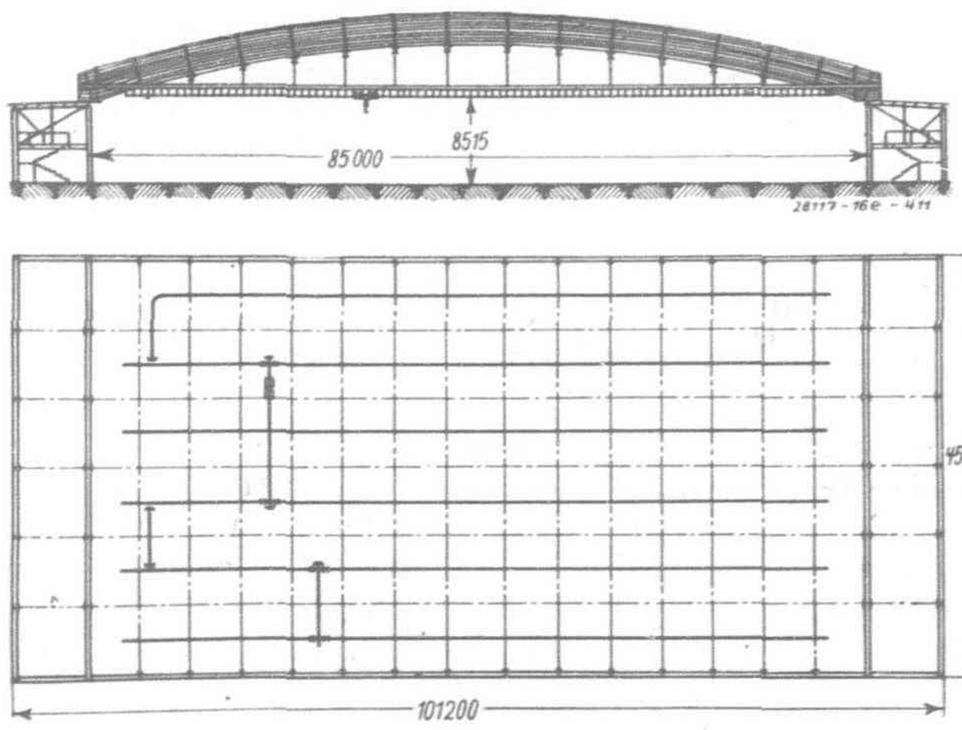
Suspension Cranes in the "Stahl und Eisen" Pavilion at the National Exhibition "Schaffendes Volk," Düsseldorf, 1937

FOR the erection and dismantling of the furnaces and other exhibits to be placed in the "Stahl und Eisen" Pavilion, it was necessary to develop a crane plant which would comply with the unusual characteristics of this pavilion, which has an unsupported span of 280-ft. (85 m). As the floor of the pavilion had to be free of all obstructions, no extra structural steelwork was allowed to be used as supports for the crane runway.

After discussions with the Exhibition Management and the Dortmunder Union Brückenbau A.-G., it was decided to install the patented Demag Suspension Cranes (Figs. 1 and 2), which were suspended from the I-beams which serve as tie rods for the arched roof in the pavilion built by the Dortmunder Union Brückenbau A.-G. Supports were thus unnecessary.

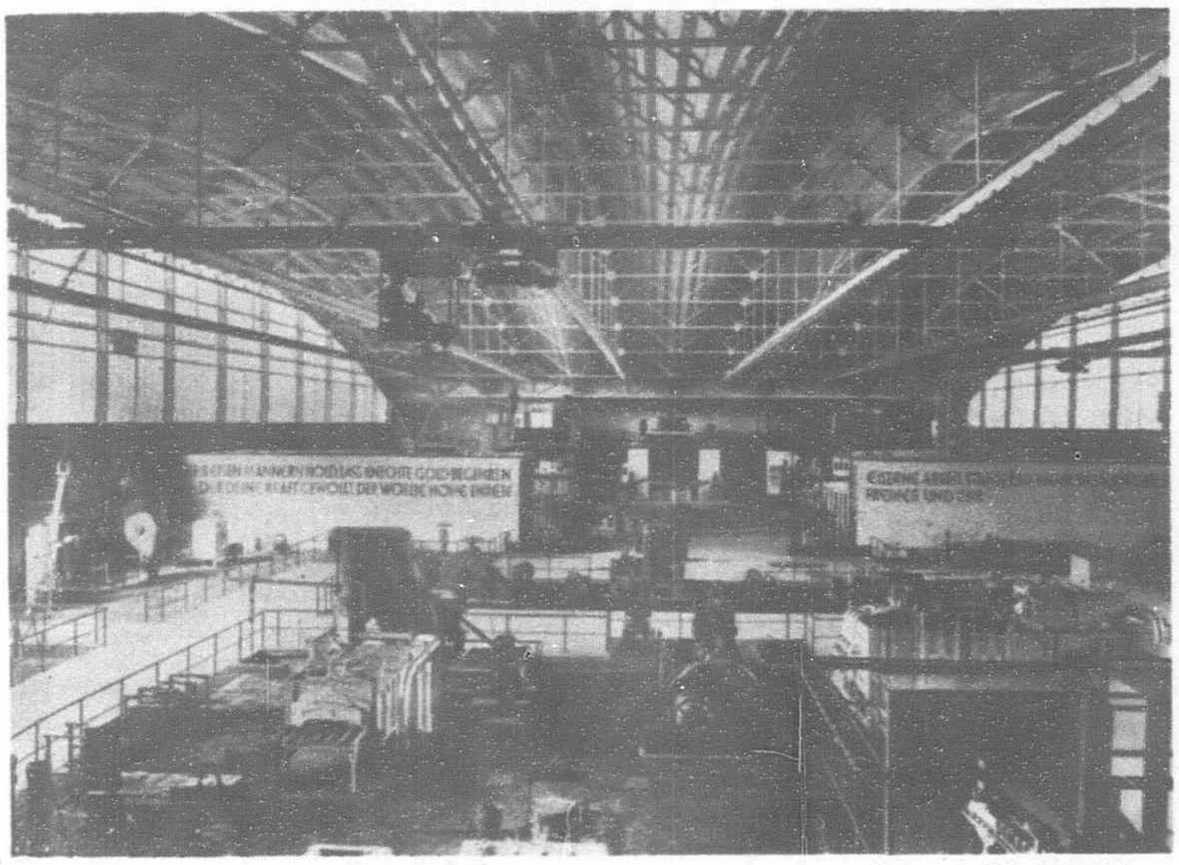
The crane runways (Fig. 3) are not fixed rigidly to the ceiling, as is otherwise customary, but can pendle within certain limits. This pendulating runway is one of the outstanding innovations in Demag suspension cranes, because by this means it is impossible for the crane through canting to stick between the flanges of the track

(Continued on page 288)



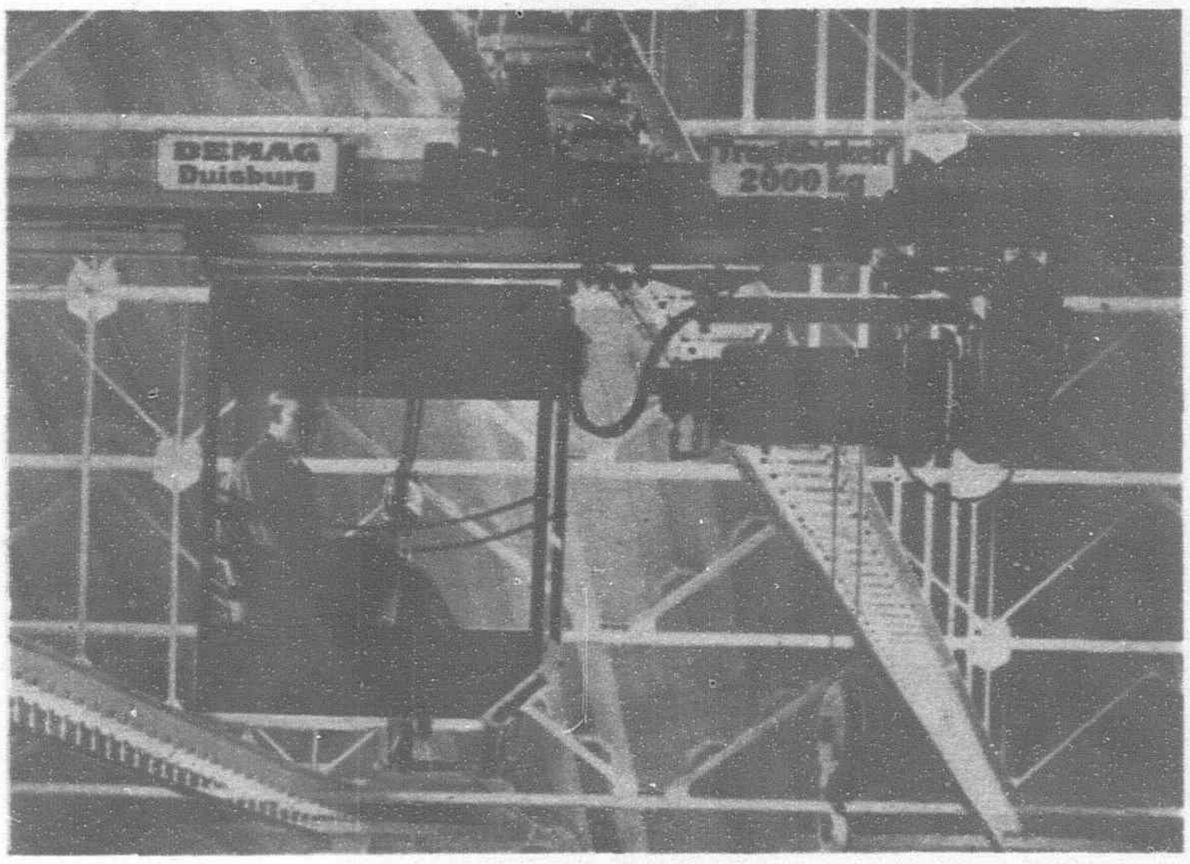
Demag Photograph

Fig. 4.—Plan of the Demag suspension crane plant in the "Stahl und Eisen" Pavilion



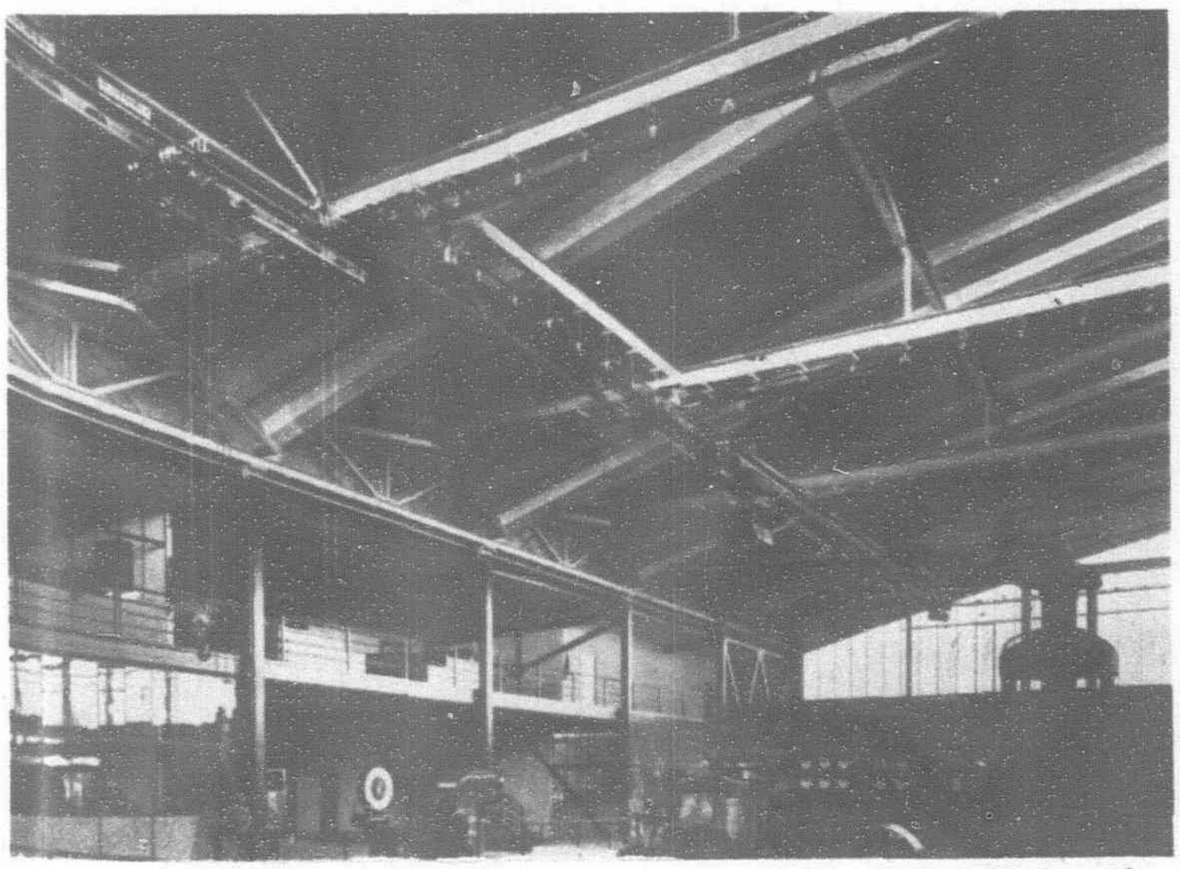
Demag Photograph

Fig. 1.—Patent Demag suspension cranes in the "Stahl und Eisen" Pavilion at the National Exhibition "Schaffendes Volk"



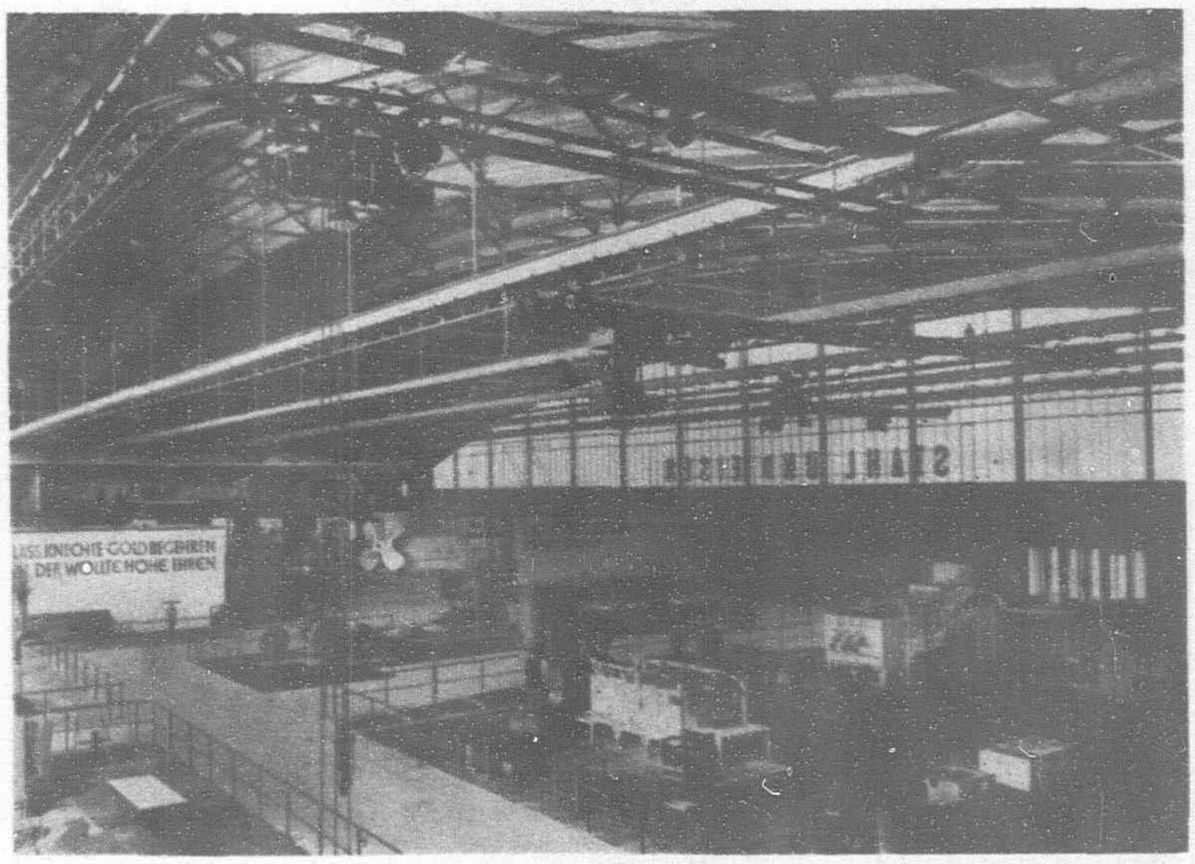
Demag Photograph

Fig 2.—Demag suspension track crab of two tons carrying capacity with electric travelling drive, which is controlled from the coupledon driver's cab



Demag Photograph

Fig. 3.—Pendulating crane runways. The crossing piece can be seen in the center of picture



Demag Photograph

Fig. 5.—Demag suspension track crab of two tons carrying capacity with electric travelling drive, which is controlled from the floor, to be seen in to top left corner

Electricity in Manchuria*

DATING back fifteen years behind that of Japan, the history of electric enterprises in Manchuria begins in October, 1902, when Czarist Russia, having commenced the construction of the city and the harbor of Dairen for the purpose of developing it into a base of commercial activities in the Far East, established a power-plant on Hama-cho, the first ever to be built in Manchuria. The plant was, however, constructed on a small scale, generating merely 260 kilowatts and supplying electricity to 30,000 lamps.

Along with other industries in Manchuria, the number of electric enterprises, which have shown remarkable development, has greatly increased during the past three and half decades. The degree of their development may be divided into the following three stages :

1st Stage : After the Russo-Japanese War up to 1911
2nd Stage : 1912 to 1930
3rd Stage : 1931 to present

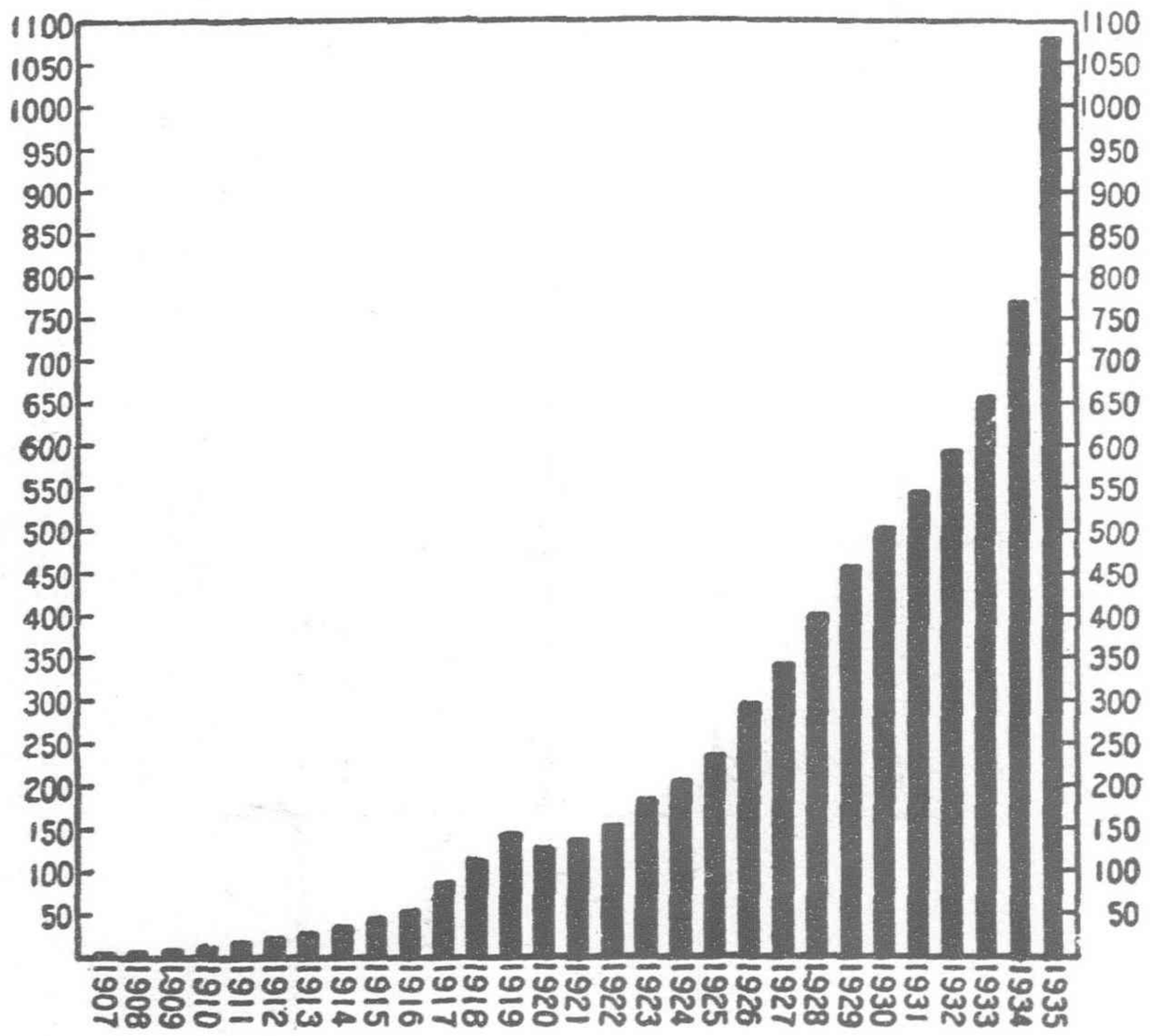
First Stage.—When the South Manchuria Railway Company was established in April, 1907, with the important mission of developing Manchuria, the Company immediately undertook both to expand the electrical equipment together with other attached enterprises along the S.M.R. line, and to build new ones. First of all, in November of the same year, it enlarged the Dairen power-plant, following which it established new plants in Fushun and Mukden in 1908, in Changchun (now Hsinking) in 1910, and in Antung in 1911, and began supplying electricity to the public.

At Port Arthur (Ryojun) there was electrical equipment (used by the Russians for charging barbed wire entanglements and other defensive measures), generating 120 kilowatts. When Japanese troops occupied Port Arthur in 1905, this equipment was repaired, and light was supplied both to government offices and to the general public. Later, when with the development of the city, the supply became short, the Kwantung Government established a new generating station of 500 kilowatts, and commenced its operation in 1907. New plants were also built in Chinchou, Pitzuwo and Pulantien.

The development of Japanese electric enterprises along the S.M.R. line, and in the Kwantung Leased Territory, provided great impetus for the establishment of Manchurian electric enterprises ; new companies were founded in Harbin (1905), Manchouli (1906), Kirin (1907), Mukden (1909), and in Changchun (1911). Thus, by 1911, almost all the principal cities of Manchuria were supplied with electricity.

Statistics on Amount of Electric Power Generated in Manchuria

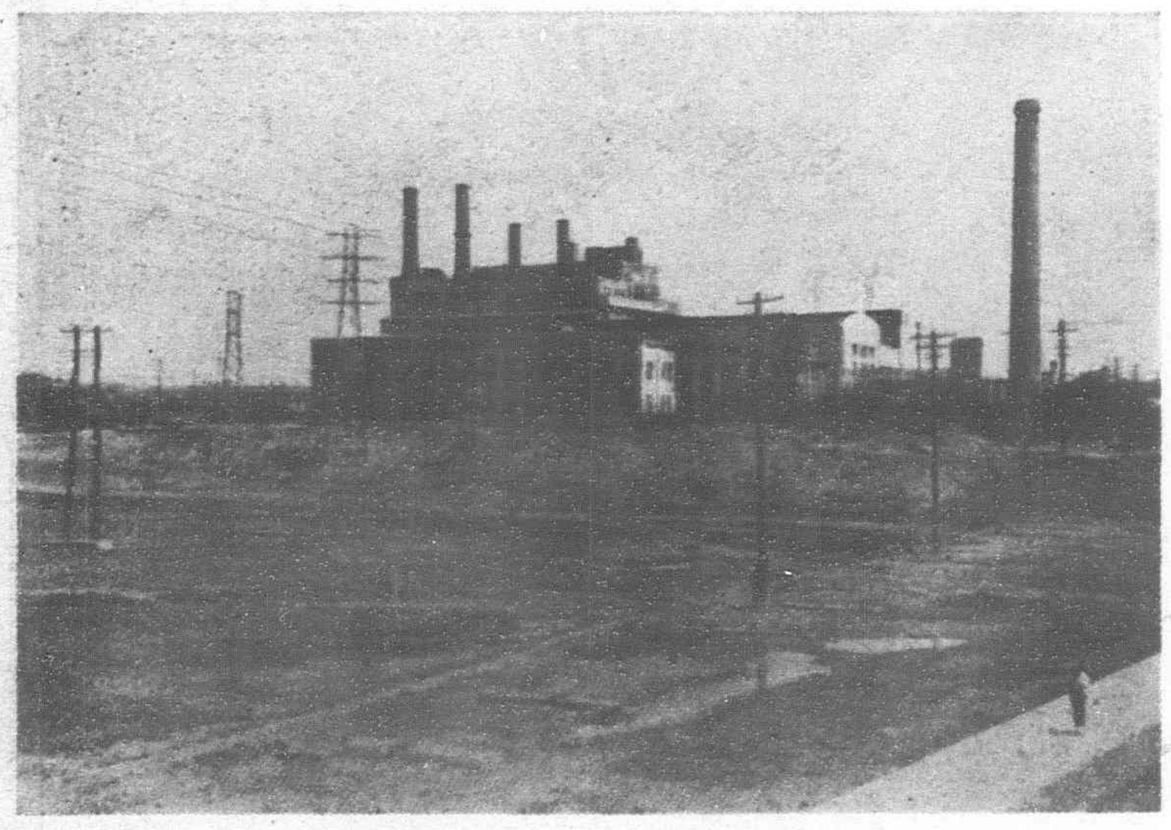
(Unit : 1 Million K.W.H.)



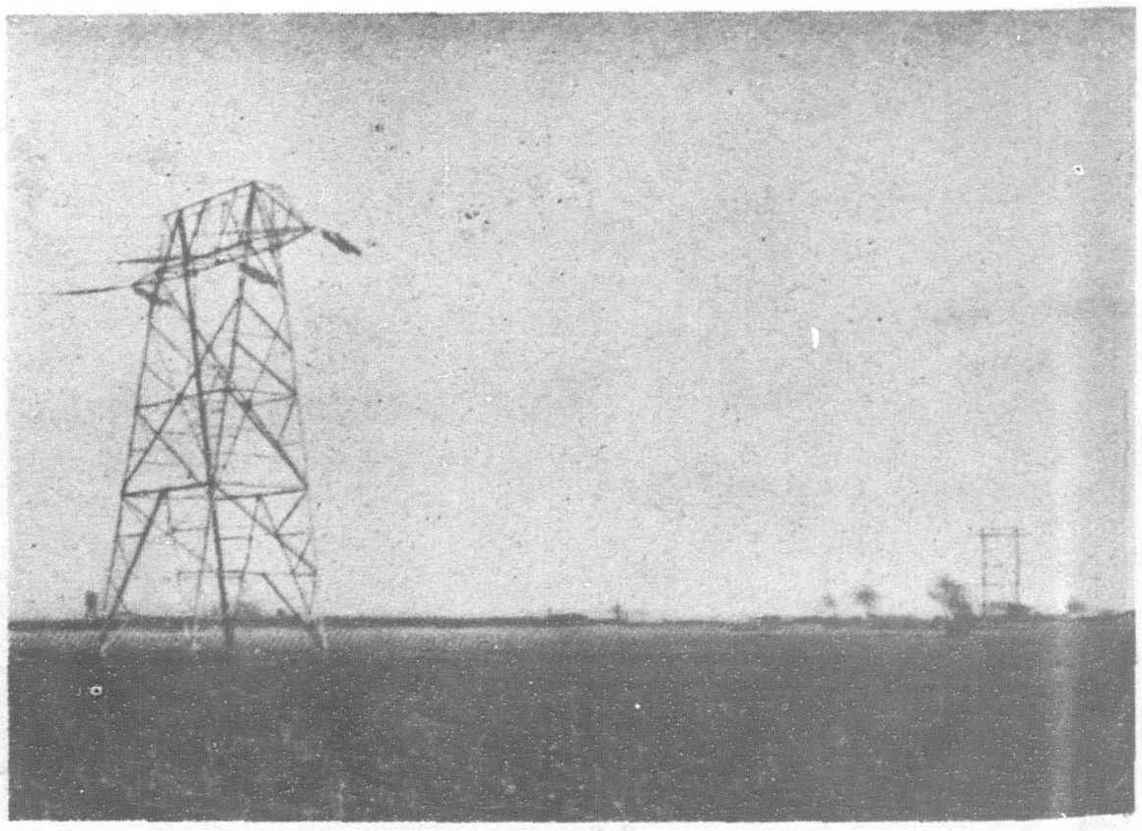
Second Stage.—Beginning about 1912, many of the existing Japanese plants were enlarged and, owing to the distribution of light to towns and villages located between the principal cities, and to a general increase in the demand for electricity, new stations were established. Furthermore, along with the improvement of business in Manchuria due to the outbreak of the World War in 1914, electric enterprises continued to show favorable development. Marking the beginning of the so-called "long-distance current supply period," the South Manchuria Electric Company was established in June 1926, and all the electric enterprises along the S.M.R. line were brought under its management.

The favorable development of the Japanese enterprises, gave further stimulus to the establishment of many small Manchurian electric companies in various parts of the country. The latter,

**Contemporary Manchuria.*



Amanokawa Power Plant, Dairen



Power transmission line carrying the "Light of Civilization" across a Manchurian Plain

however, with the exception of two or three, showed poor business results because of the shortage of funds, the lack of technical skill and knowledge, and extortions by both militarist and Government officials. About this time, the movement for the recovery of rights and interests acquired by foreigners in China, which had spread into Manchuria from China Proper, gained momentum and severe pressure was brought to bear upon the Japanese electric enterprises, in full disregard of the weak economic power of Manchuria and of the nature of public utilities.

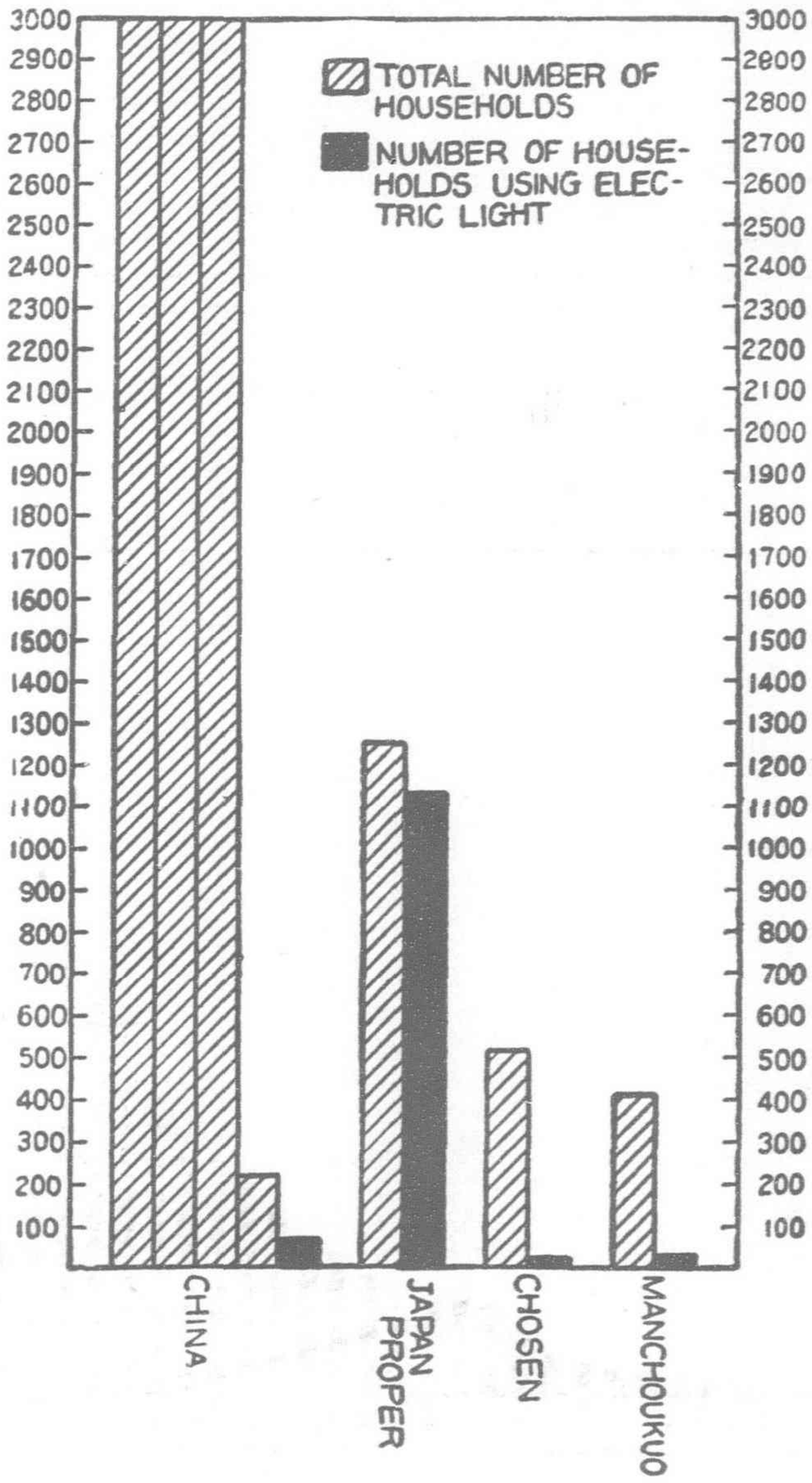
The Japanese electric enterprises were refused the right to supply light and power to Manchurian territory. Being compelled to confine their business to the narrow strip of land along the S.M.R. line, wherein the demand for electricity had almost reached a saturation point, the future of Japanese enterprises looked none too bright.

Third Stage.—However, with the birth in the wake of the Manchurian Incident of the new State of Manchoukuo in 1932, the situation changed completely, and the electric industry began to see the light of future development. Fully realizing the basic importance of electric enterprises in the development of industries in the new Empire, the Manchoukuo Government, in an announcement made both at home and abroad in March 1933, on its fundamental policy for the economic reconstruction of Manchoukuo, declared that electric enterprises will be placed under controlled management, and power will be supplied abundantly and cheaply.

Thus the political impediment to the development of Japanese enterprises was removed and, with the growing desire of the Manchoukuo Government for Japanese support in management and technical skill, an opportunity matured both for the expansion of existing enterprises and for the establishment of new ones. A proposal to merge all the electric enterprises in Manchuria was brought up by the Japanese and Manchurians concerned, and finally culminated in the establishment in November, 1934, of the Manchuria Electric Corporation, capitalized at Y.90,000,000, under joint Japanese-Manchoukuo investment. The greatest institution to come under the new scheme was the South Manchuria Electric Company, a subsidiary of the South Manchuria Railway Company, which, since the merger, has come to be known as the Dairen branch of the Manchuria Electric Corporation. The new Company aims to effect a complete control and a unification of the electric industry in the country.

Distribution of Electricity

(Unit: 1 Million Households)



Distribution of Electricity

Despite the rapid development of electric enterprises in Manchuria in recent years, electricity for lighting is still used only by a small portion of the population. Practically all the peasants, who comprise the greater part of the population, are without electric light. According to an investigation made by the Manchuria Electric Corporation, 338,265 households in Manchuria (including the Kwantung Leased Territory), representing only 5.9 per cent of the total number of households (5,753,841), were supplied with electric light at the end of 1935. The total number of lamps was 2,334,050, or 6.7 lamps per hundred of population (34,648,630), in striking contrast to 59.4 lamps per hundred of population in Japan. The number of lamps installed in the city of Osaka alone, which had 2,753,751 lamps at the end of 1934, is larger than that of the whole of Manchoukuo. The following table gives the distribution of electricity in Manchuria at the end of 1934, in comparison with China, Korea and Japan Proper :—

	Total number of households	*Households supplied with light*	*Percentage*
Manchuria	5,275,580	285,433	5.4
China	92,193,348	683,914	0.7
Korea	4,290,000	315,594	7.4
Japan Proper	12,705,896	11,715,694	92.2

" The Light of Civilization " in Manchuria, on the left a street in a Manchurian village ; on the right, light and power lines in a Manchurian town

Chart Showing Percentage of Households Using Electricity in Ten Principal Cities

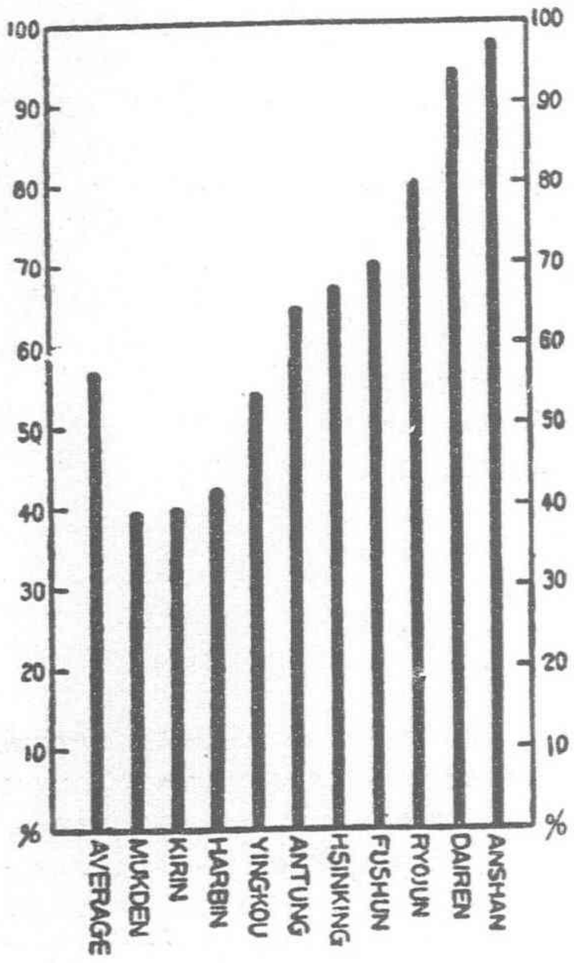
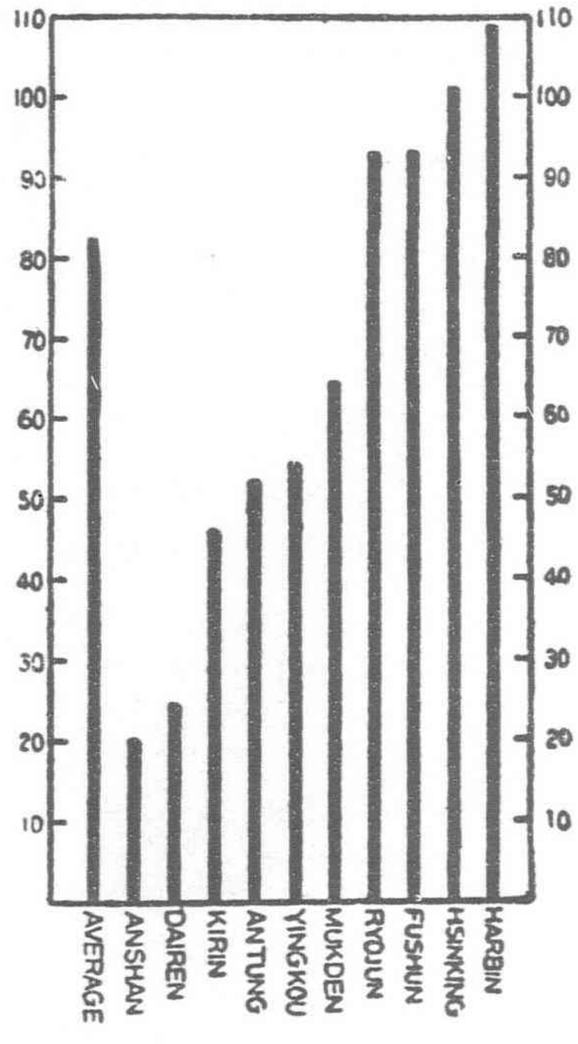


Chart Showing Number of Lamps Per 100 of Population in Ten Principal Cities



As reasons for the small use of electricity may be mentioned the low density of population and the low standard of living of the masses who are mostly peasants, who get up and start working at sunrise and go to sleep at sunset. The low standard of living of the populace, however, was not the sole cause of the small use of electricity, for there were also political reasons. The former Northeastern military régime, swayed by a strong sentiment of anti-foreignism and jealous of the growing prosperity of Japanese electric enterprises in Manchuria, out of a sheer desire to cause economic losses to them, had small generating stations established indiscriminately at various places to engage in unfair competition with Japanese interests. These new Manchurian electric companies were not only economically unsound, but were also handicapped in business, because no improvements were made in their facilities nor any attention paid towards popularizing the use of electricity among the masses. The result was a heavy burden upon the consumers, who also had to suffer from uncertain and irregular service. The widespread use of electricity and the high state of development attained by the electric industry in the Japanese-administered Kwantung Leased Territory and the S.M.R. Zone, offered a striking contrast to the condition in the territory under the control of the former Northeastern régime. The following table shows the increased use of electricity in the two above-mentioned districts since 1907 :—

Year	*Number of lamps*	*Year*	*Number of lamps*
1907	8,177	1922	479,429
1908	11,821	1923	513,851
1909	37,205	1924	535,593
1910	58,776	1925	564,269
1911	79,863	1926	584,444
1912	96,837	1927	608,264
1913	117,404	1928	666,439
1914	135,813	1929	707,801
1915	149,341	1930	708,796
1916	183,135	1931	714,743
1917	228,730	1932	793,775
1918	277,124	1933	899,678
1919	347,639	1934	976,906
1920	405,781	1935	1,173,057
1921	442,420		

(Investigation by Manchuria Electric Corporation)

As the above table shows, the total number of lamps in the Japanese-administered districts in 1935 was 1,173,057, representing 70 lamps per hundred of population, as compared with 59.4 lamps per hundred of population in Japan Proper at the end of 1934.*

The accompanying table gives a comparison of the distribution of electricity in ten principal cities of Manchuria and six principal cities of Japan at the end of 1934 : †

	No. of households to every 100 households using electricity	*No. of lamps per household*	*No. of lamps per 100 of population*
Manchurian cities	47.5	7.6	82.5
Japanese cities	94.2	5.7	110.5

Although the percentage of electricity used by the households in Manchuria is equal to only about one-half of that in Japan, as the former includes Manchurian households, the number of lamps to each household is, as the previous table shows, greater than in Japan. Thus in the principal cities of Manchuria, at least, there is a fairly widespread use of electricity. Details regarding the use of electric light in the ten principal cities of Manchuria at the end of March 1935, are :—

Cities (including their suburbs)	*No. of households*	*Population*	*No. of households using electricity*	*Percentage of households using electricity*	*No. of lamps*	*No. of lamps per household*	*No. of lamps per 100 of population*
Port Arthur ..	6,258	30,580	5,046	80.5	28,499	5.6	93.1
Dairen ..	61,923	326,973	58,629	94.6	373,776	6.4	24.2
Anshan ..	5,455	29,171	5,301	97.2	32,173	6.1	20.2
Mukden ..	106,111	630,002	41,090	39.7	404,674	9.9	64.2
Hsinking ..	32,493	176,658	21,955	67.6	182,094	8.3	101.5
Kirin	18,187	100,826	7,290	40.0	46,760	6.4	46.3
Harbin ..	82,346	309,160	34,817	42.3	337,408	9.7	109.0
Fushun ..	13,712	81,092	9,663	70.4	75,656	7.8	93.3
Antung ..	28,514	162,743	18,729	65.7	85,187	4.6	52.3
Yingkou ..	18,348	99,045	10,054	54.8	53,568	5.3	54.1
Total ..	373,346	1,949,240	212,552	57.0	1,619,745	7.6	82.5

(Investigation by Manchuria Electric Corporation)

The electric light rate in Dairen, Antung, Hsinking and Mukden, where electricity is supplied by the Manchuria Electric Corporation, is MY.2.00 per 10 kilowatt-hours. This is by no means high when compared with the rates in principal cities of Japan and China, the rates in Kyoto being Y.1.85 per 10 kw. ; Tokyo Y.1.95 ; Nagoya and Kobe, Y.2.05 ; Yokohama, Y.2.20 ; Osaka, Y.2.41 ; Shanghai, $1.80 ; Tientsin, $2.50, and Peiping, $2.20 ($1.00 is equivalent to about Y.1.06 ; MY.1.00 is equivalent to Y.1.00).

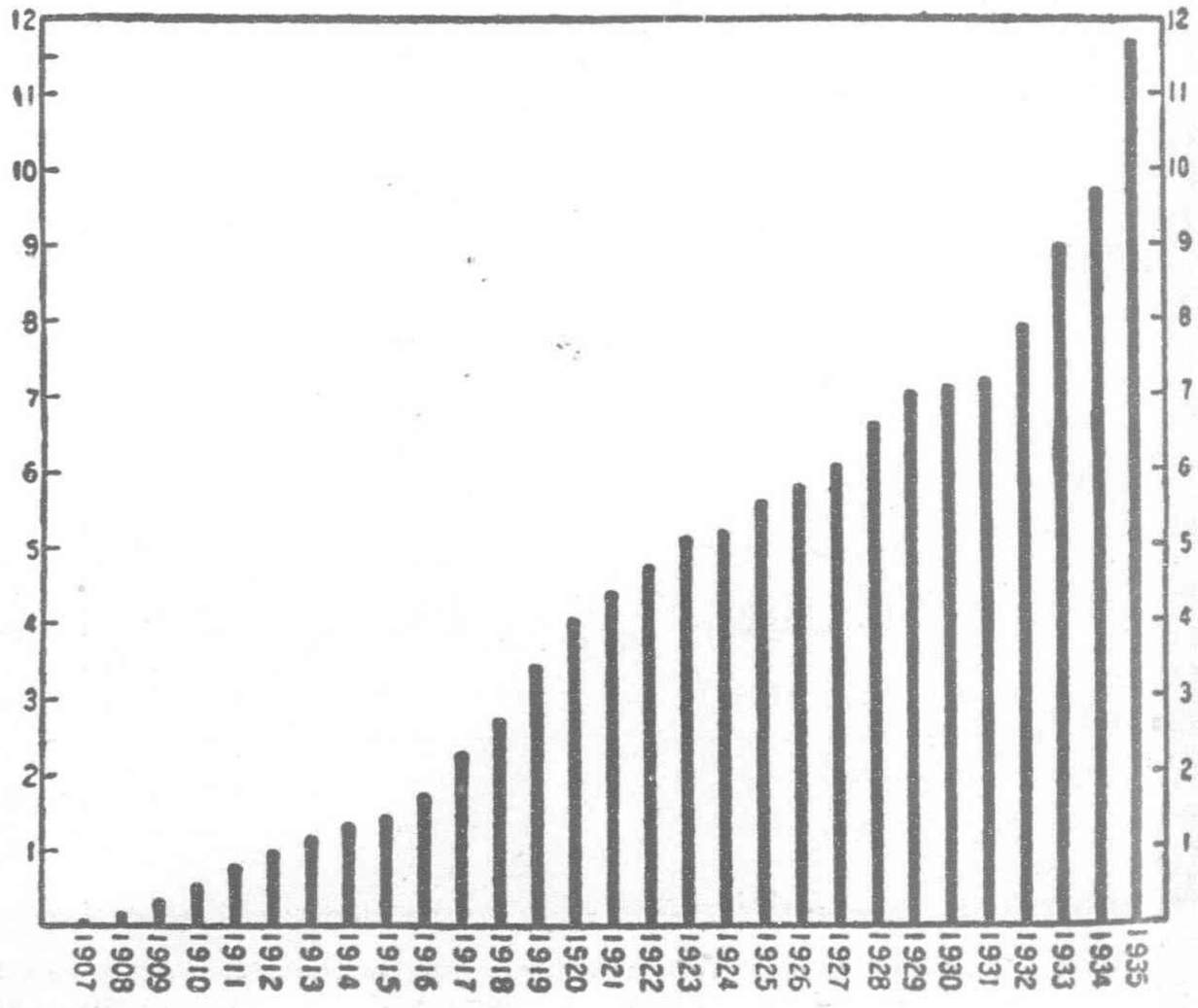
(Continued on page 288)

*According to the Year-Book of Electrical Industry of Japan (1936), the population of Japan at the end of 1934 was 68,194,908, and the number of lamps 40,532,219, representing 59.4 lamps per hundred of population.

†Figures obtained from the Year-Book of Electrical Industry of Japan (1936).

Statistics on the Number of Electrical Lamps in the Kwantung Leased Territory and the S. M. R. Zone

(Unit : 100,000 lamps)



Some Aspects of Track Maintenance on the Peiping-Suiyuan Railway*

By T. KING, Chief Engineer, Peiping-Suiyuan Railway

This paper was read, April 17, 1937, at the Annual Meeting in Peiping of the Association of Chinese and American Engineers.

In this paper, without repeating what has been described in previous articles, I shall make an endeavor to point out some aspects of track-maintenance, specially found on our Railway, with little or no reference to the usual routine work of maintenance that may be common to all railways.

Superelevations on Curves

The customary standard on this Railway calls for rather excessive superelevations of outer rails on curves. Such superelevations do not correspond with the comparatively low train-speeds now allowed throughout various parts of the line. For example, curves of 600-foot radius in the Nankow Pass had a superelevation of 5-in., which was far too much for a train-speed of 12 or 15 mi. per hour. The result is that the inner rails carrying an undue proportion of the moving load have shown hair cracks immediately under the railhead, or the head portion of such rails has been more or less deformed, i.e., bent toward the center of the track. Again, curves on various parts of the line, other than the Nankow Pass, have been provided with superelevations as required by a train-speed of 40 mi. per hour. As a matter of fact, the speeds allowed in the past ten years were only 20 to 25 mi., and it is only since October 1, 1936, that the maximum train-speed on the whole of the main line, except in the Nankow Pass, has been brought up to 30 mi. per hour.

In view of the above, a general order was issued to all section engineers to reduce the excessive superelevations to those fixed by the Ministry of Railways, which are based upon the formula

$$E = 0.009864\ DV^2,$$

in which E = superelevation in millimeters,
D = degree of curve (20-meter chord)
and V = train-speed in kilometers per hour,

or, what is the same thing, in British units,

$$E' = 0.00066\ D'\ S^2$$

in which E' = superelevation in inches,
D' = degree of curve (100-foot chord)
and S = train-speed in miles per hour.

The train-speed assumed in arriving at the new superelevations is 35 mi. per hour for all parts of the main line except the Nankow Pass. As for the sharp curves in the Nankow Pass the maximum superelevation is temporarily fixed at 2½-in., which corresponds with a speed of 20 mi. per hour. With the gradual increase in the number of manual applications of lubricants on such curves (which is described under another heading in this paper), it is expected to further reduce the maximum superelevation to about 2-in.

Most of the sharp curves in the Nankow Pass are situated on very steep grades of 1 in 30. The usual practice on this Railway is to keep the inner rails at grade and elevate the outer rails to the full amount of superelevations as required. This constitutes a heavy task on the tractive power of the locomotives in climbing up the grade and turning around the curve. We are now trying to alter our practice to that fixed by the Ministry of Railways which

* *Journal of the Association of Chinese and American Engineers.*

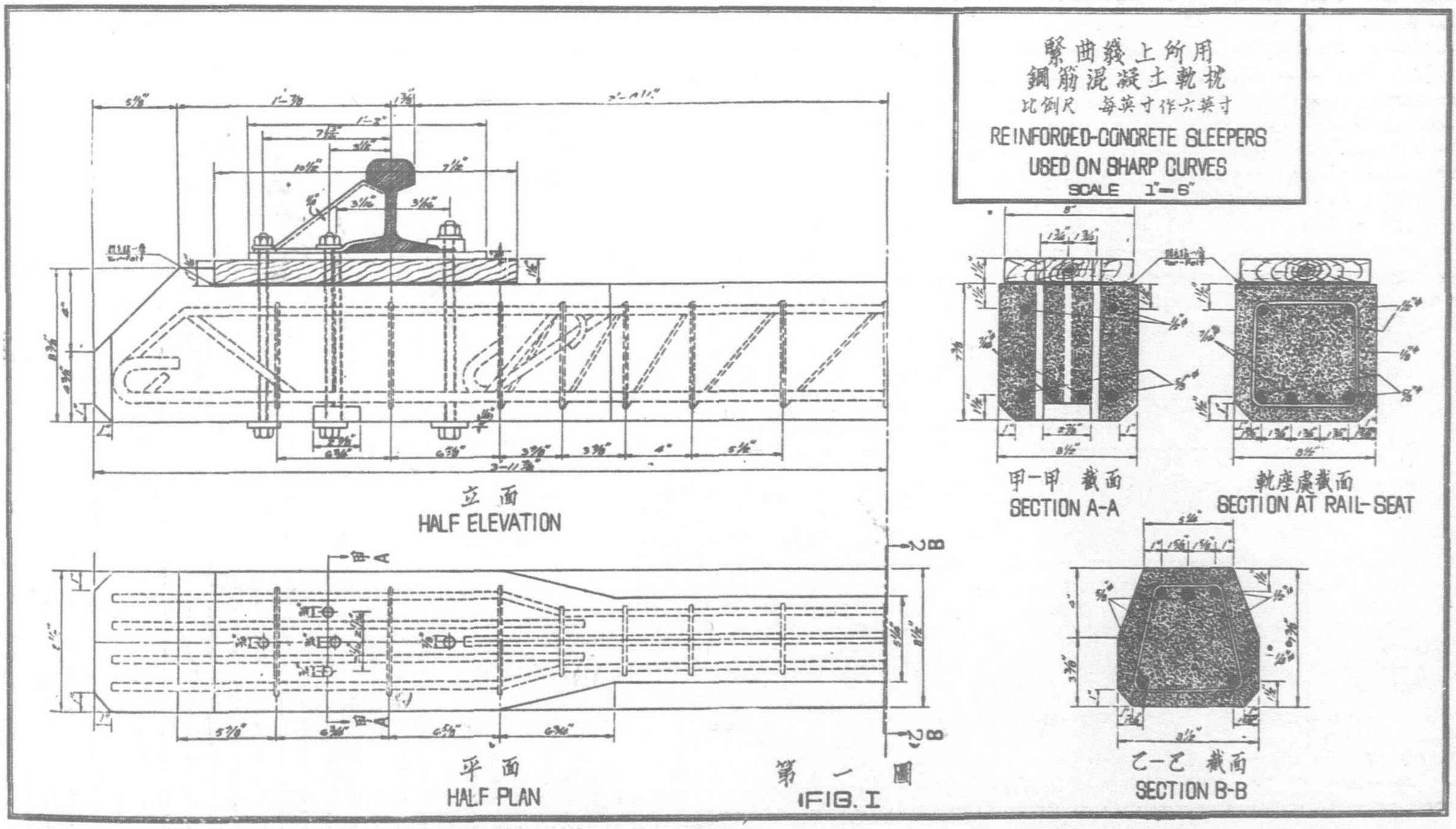


Fig. 1.—Sketches with details of reinforced-concrete sleepers, used on sharp curves, which were experimented with on curves in the Nankow Pass of the Peiping-Suiyuan Railway. Interesting particulars of the trials are given in the Chief Engineer's Article

is to have the inner and outer rails lowered and raised respectively by half the required superelevation.

According to our usual practice, the runoff at each end of the curve, where there is no transition curve, begins at P.C. or P.T., and rises toward the middle of the curve, so that the full superelevation is not realized near both ends of the curve. The recent practice is to maintain the full superelevation throughout the simple curve, and to have it run out on the tangents beyond the P.C. and P.T., as fixed by the Ministry of Railways.

Manual Lubrication on Curves

On the numerous sharp curves in the Nankow Pass, the friction between railhead and wheel flanges causes considerable and quick wear in the former (and in the latter, too), in spite of the fact that sorbitically heat-treated rails are used in that part of the line.

In 1934 the installation of automatic lubricators such as the Ardco Rail Lubricator manufactured by the Lundie Engineering Corporation, New York, U.S.A., was considered, but the cost of the latter (U.S.$300 per set) prevented the Railway Administration from adopting them. We were then obliged to resort to the practice of manual lubrication. This was commenced in April, 1935, on two curves of 1,000-foot and 600-foot radii, of which the outer rails had been found very easily worn away. The result of this trial was fairly satisfactory. Beginning from July, 1935, all curves of 1,000-foot radius or less in the Nankow Pass were lubricated by the patrolling trackmen. The lubricating mixture is applied at or near each end of the curve to the gage side of the railhead (not to the top of the railhead) at an average rate of four times per curve per 24 hours. This mixture is made up of four catties (one catty is approximately equal to $1\frac{1}{3}$ lb.) of linseed oil and two catties of graphite, for the daily application to all the curves. The total daily cost for all the cuvres of 1,000-foot radius or less in the Nankow Pass amounts to about $1.10, the wages of the patrolling trackmen applying the lubricant not being reckoned in this figure.

The application four times per day is considered rather insufficient, and it is now proposed to increase the number of applications per day and to engage a few more workmen, in addition to the regular patrol men, to do this work.

Maintenance of Gage

In the Nankow Pass where very heavy Mallet locomotives run back and forth with great frequency day and night, it has been found rather difficult to keep the track at the proper gage. This difficulty arises mostly on curves of less than 900-foot radius, and at some places on flatter curves or even on tangents, especially where the soft-wood sleepers are in a more or less decayed condition.

According to the standard set down by Dr. Jeme Tien Yu, track gage on curves is allowed to be widened to the extent of $\frac{3}{4}$-in., but due to the action of the heavy locomotives, the gage on curves of 600-foot radius often spreads to $1\frac{1}{8}$ or $1\frac{1}{4}$-in. With the use of gage-rods, four per rail-length, at a widening of 1-in. on curves of 600-foot radius, no further spreading of gage has been found. These gage-rods consist of $\frac{3}{8}$-in. × 2-in. × 4-ft. 2-in. flat steel bars forged onto the tie plates and are placed on top of the wooden sleepers. The widening of gage, as fixed by such rods, is 1-in. for curves of 600-foot radius, $\frac{7}{8}$-in. for those of 700-foot radius, etc. Each rod in place is estimated to cost 81.6 cents.

We are now experimenting with another simpler device which consists of replacing the above bars by long bolts of suitable diameter running through the webs of both rails at their neutral axes. These bolts should be easier to be applied and removed, and cost less than the flat bars.

Track in the Pataling Tunnel

Nearly the whole of the side drains in the Pataling Tunnel are of the open type, with the exception of a covered length of 300-ft. near its northern portal. Formerly the spring water running in such drains was not frozen to any great extent ; but during the very low temperatures which have been experienced in the last few winters the water has been frozen on its way down the open drains. The accumulation of water running on top of the ice results in overflows close to the track which greatly handicap the operation of trains through the tunnel. Workmen constantly removing the ice from such drains perform their work with great difficulty, and at any time are liable to be knocked down by passing trains. This year we have decided to cover up all of the drains on both sides of the track in order to prevent the water from freezing and to eliminate trouble in train-operation in the tunnel.

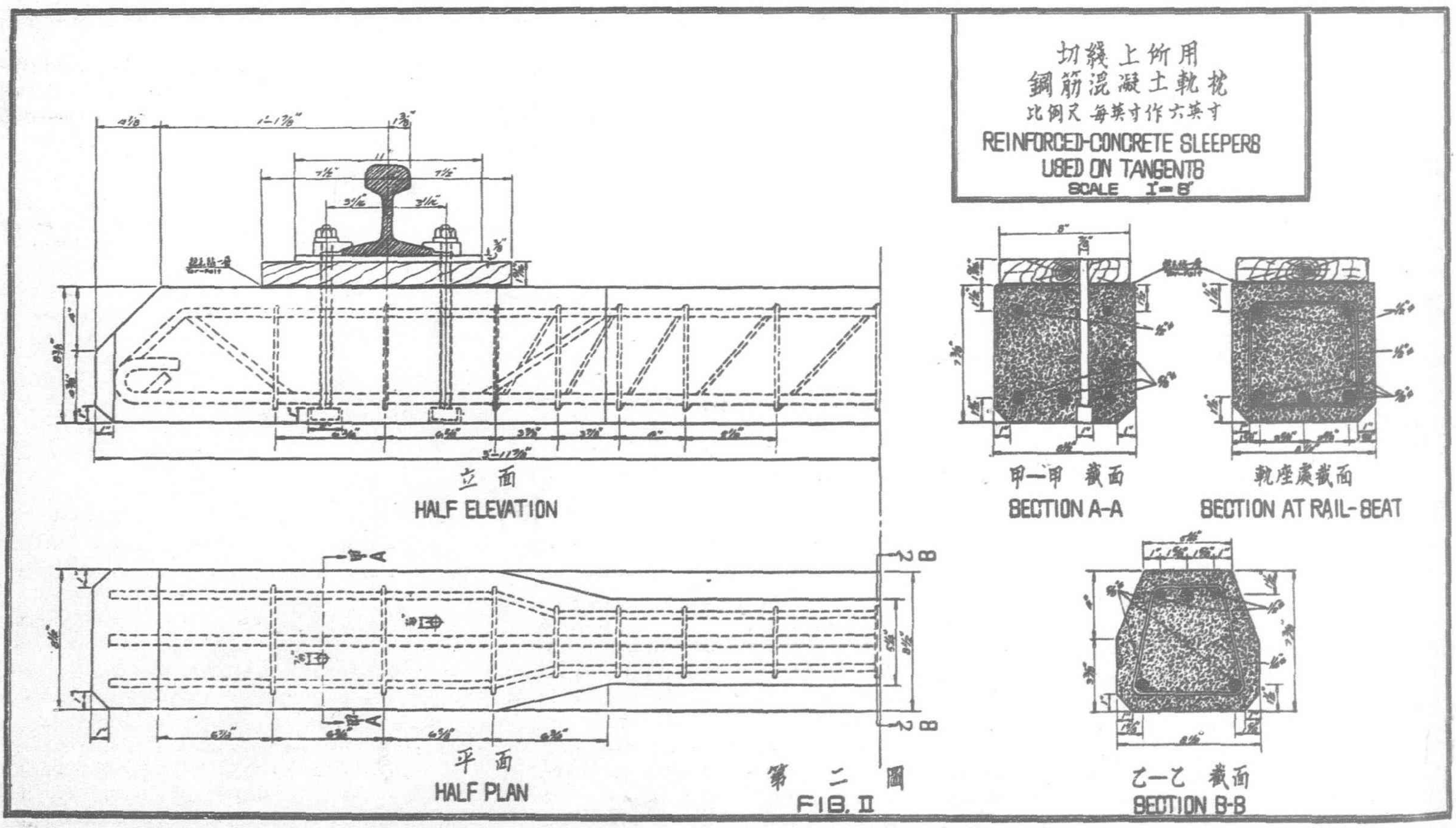


Fig. 2.—Sketches, showing slight modifications in the construction of reinforced-concrete sleepers for installation on sharp curves of the Peiping-Suiyuan Railway, as deemed advisable following the trial periods of the sleepers, shown in Fig. 1

The rails in the tunnel corrode very badly due to the moisture in the air which comes from the smoke of the passing locomotives. In the course of time the dimensions of the rails are reduced by about $\frac{5}{8}$-in. It was necessary in September, 1936, to re-lay all the 234 pieces of rails in the tunnel. At the time of re-laying, the new rails and fastenings were painted with coal tar and they will hereafter be repainted once a year.

Rail Creeping

Rail creeping, to a greater or less extent, has been found throughout nearly the whole of the main line and the three branch ines. There are, however, three stretches of the main line in which rail creeping deserves special mention.

The first is in the Nankow Pass. In my previous article, "The Nankow Pass on the Peiping-Suiyuan Railway," I made a remark as follows: "This extra fishplate (angle bar) and the longer sleepers are used with the idea of preventing rail creeping." Such measures only help to some extent to reduce the amount of creeping. As a matter of fact, the trackmen in the Pass are constantly kept busy in pushing back the crept rails in order to prevent train accidents from this cause.

The second stretch is one about 2½ mi. long situated to the east of Tienchen (approximately midway between Kalgan and Tatunghsien). The amount of creep runs up to as much as one foot or even more.

The third portion of the main line in which great trouble from rail creeping has been found recently is the relocated line between Chininghsien (formerly Pingtichuan) and Kisiaying, where second-hand 90 lb. rails were used in 1935, as described in my previous article, "The Peiping-Suiyuan Railway and Its Extension From Suiyuan to Paotow." The angle bars of such rails are not provided with slots or holes for receiving the spikes as is the usual practice in other parts of the Railway. These slots or holes prevent rails from creeping to a certain extent, although it may appear undesirable to strain the angle bars unduly. The absence of the slots or holes and the fact that the relocated line has a more or less continuous grade of 1 in 160 consitute a combined cause for serious creeping, in addition to the fact that our freight traffic runs generally in one direction only, i.e., from west to east.

In 1936, we placed a trial order for two types of anticreepers, 1,500 pieces each of the "Fair" and "Henggi" types. Upon their arrival in October last, the anticreepers were at once installed in the above-mentioned stretches of track. Up to the present (February, 1937), they have been found very satisfactory, resulting in no creep or at most $\frac{1}{8}$-in. creep where they have been in use. The "Henggi" type seems to be preferable.

This year we planned to buy about 110,000 pieces of the "Henggi" anticreepers to be used throughout the whole line but the financial condition of the Railway does not permit this plan to be realized. We shall be contented, at present, in buying 25,000 pieces of the same, mostly for use in the relocated line, and the rest to be distributed in other parts of the main line where creeping is found most serious.

Heaving of Track by Frost

At a great many places west of Kangchuang, our tracks on the main line and on the Tatunghsien-Kowchuan branch are heaved by frost every winter. The amount of heaving varies with the quantity of water found in the cutting, with the depth of ground-water level under the roadbed, and with the atmospheric temperature of the season. In some cases the track is heaved to the extent of an inch or so while in other extreme cases the heaving sometimes runs up to over one foot.

Very bad heavings are experienced nearly every winter in the long wet cuttings, one to the south of Fengchen and another to the south of Chininghsien (formerly Pingtichuan). In the former, the poor soil has, in the past years, been gradually replaced with rubble or gravel down to a depth below the frost line and the heaving in the last few winters has been found greatly reduced As for the latter cutting, we expect to do the replacement of the original soil by making use of the accumulated cinders now piled up in the locomotive shed at Chininghsien. This work will be done this year.

The station yard at Suiyuan and nearly the whole section from Suiyuan to Paotow suffer from track-heaving every winter. Such heavings are due to the fact that the underground water level in that region is too near the ground surface, and this is especially so when there has been plenty of rainfall in the preceding autumn, and cold winter begins early before the groundwater level has any chance of being lowered by percolation or drainage.

The tracks in Shihpatai also suffer from heaving every winter, due to water coming down from a wet cutting immediately to the west of that station.

Before any costly measures can be taken to remedy permanently the above-said evils, some makeshift way must be resorted to in order to provide a practicable and comparatively safe track for trains to pass over. Where the heaving is not excessive, say not over two inches, wooden shims are used. Should the heaving be found to be more than two inches, a certain amount of ballast is removed from under the sleepers, besides the use of shims at nearby low points. Each cold night causes considerable heavings early in the morning, and warm sunshine the following day may result in the track dropping to its usual level in the afternoon. A good deal of trouble is experienced in raising and lowering the track every day in the winter season, and at places where excessive heavings are found not only all the workmen in the section gang concerned but also a fly gang of ten to fifteen men are kept busy day and night in fighting against this trouble.

Switches and Frogs

With the delivery of a large number of sets of switches and frogs ordered in 1935, as mentioned in my previous article, "The Peiping-Suiyuan Railway and Its Extension From Suiyuan to Paotow," a considerable number of worn-out or broken switches and frogs have been replaced. These old switches and frogs, together with worn-out rails taken out of the track, would have been scrapped if there were no way of reconditioning them, as was the case prior to 1935. Beginning from that year, a welding gang was organized at the Hsichihmen station, Peiping. This gang performs most of its work in co-operation with another gang of blacksmiths. The kinds of work now handled by these gangs are quite numerous and varied. They may be classified under three general headings, namely: (1) repairing switches and frogs, and much other equipment such as signal parts, switch stands, parts of motor trolleys, hand trolleys and hand push cars, etc., (2) fabricating new frogs by making use of two or more sets of broken or worn-out ones and old rails and (3) hardening the newly purchased switches and frogs (the steel of which was found too soft) by heat treatment.

Table I shows the amount of work done in 1936, and the cost of labor and materials. It should be noted that most of the materials consumed consist of oxygen and acetylene gases used in welding and cutting.

TABLE I

Kind of Work	*No. of Pieces*	*Cost of Labor and Materials in Dollars*
Making new frogs	17	1,318.52
Making new guard rails	2	3.72
Repairing frogs	90	4,072.56
Repairing switches	2	30.49
Repairing stock rails	4	32.41
Cutting old rails for fence posts	27	18.11
Reconditioning angle bars	8	2.07
Repairing parts of signals, trolleys, and other equipment	—	101.66
Heat-treating new frogs	16	216.71
Total		5,796.25

The two gangs, being under one and the same ganger, consist of two welders, three blacksmiths, three apprentices for welders, six apprentices for blacksmiths and four unskilled workmen.

The equipment and tools at the disposal of the welding gang are blowers for oxy-acetylene welding and for cutting, one pyrometer, one gas-cutting guide, one hardening furnace, four kerosene blowers for heating, two furnaces for steel-forging and a set of hand tools. In January, 1937 an order was placed for a transformer which will make use of the Peiping city current for electric arc welding. The same order also calls for one portable grinder, one drill, one hammer, and one chipper, all requiring the use of electric power. Upon the arrival of such instruments and tools, better and quicker work is expected to be done in the near future.

Reinforced-Concrete Sleepers

Some reinforced-concrete sleepers of more or less primitive designs were previously tried at Kalgan with rather unsatisfactory results.

In 1932, the Ministry of Railways got out three designs, types A, B and C, for various Government Railways to experiment with. Two lots of such sleepers made in accordance with type B with slight modifications (see Fig. 1) were installed on curves in the Nankow Pass.

The first lot, consisting of 72 pieces, was made in April, 1933, and installed in the track in May and December of the same year. Of these, 30 are in good condition, 19 have shown cracks in the middle, or breakage at end projections, but are still good for use, while 23 have been so damaged as to be of no use in the track (Seventeen of these were damaged by train derailments). The second lot of 98 pieces was made in October, 1933, and put into the tracks in March and May, 1934. Of these, 46 are in good condition, another 46 have shown cracks or breakage at end projections, but are still usable in the track, and the remaining six have been taken out of the track due to damage.

In installing the sleepers of both lots, the stone ballast under the sleepers was removed and replaced with coarse sand or fine ballast mixed with clay, while broken stone ballast was still used in the cribs. It can be seen from the above that only 12 out of 170 pieces failed from passage of trains. This might be due to poor mixing of the concrete ingredients or due to unclean sand or stone used in making the sleepers. As a whole, these sleepers have proved very useful on curves in maintaining the track gage. Each sleeper weighs 226 kg. net, and cost about $7.57, while its fastenings cost about $4.91 in addition.

In September, 1935, a third lot of 93 sleepers was made at Chinglungchiao to be used on tangents. The design was slightly modified (see Fig. 2) doing away with the end projections and diminishing the amount of reinforcements to some extent. Due to shortage of fastenings, these sleepers were not installed in the track until September, 1936, and up to the present (February, 1937) they are in excellent condition. Each sleeper in this lot weighs 216 kg. net, and cost about $6.86, while its fastenings cost about $3.90. It is reasonably expected that such sleepers will last at least twenty years.

Table II gives more detailed information concerning the sleepers of all three lots.

Although concrete sleepers as above described have shown fairly good results, there are still two points to be considered. One is the high cost as compared with ordinary untreated Oregon pine sleepers, each costing only about $3. We are trying to further modify the design with a view to bringing down the cost. The other is that these concrete sleepers have been tried only in the Nankow Pass where train speed is limited to 12½ mi. an hour. Whether such sleepers are suitable for use in tracks ready for trains to run at 30 or more miles per hour remains to be proved. We are now arranging to install a dozen or so of such sleepers as shown in Fig. 2, in open-line tracks outside of Nankow Pass where the allowable train speed is 30 mi. per hour.

Sandstorms and Snowstorms

At a great many places along the Peiping-Suiyuan Railway, we have to fight against trouble from sandstorms and snowstorms (especially the former) which, if not properly cared for, might block up the line or endanger the operation of trains.

Any one or a combination of the following three ways of remedy is usually resorted to, and the result is found fairly effective. The first is to clear the drifted sand or snow away from the track as soon as it accumulates thereon. For this purpose, some of the section gangs keep one or two additional workmen throughout the

(Continued on page 281)

TABLE II

Number of Sleepers Tested	*Date of Making*	*Date of Installation*	*Where Used Chainage*	*Alignment*	*Conditions of Damage and Number of Pieces Damaged*	*Cause of Damage*	*Number of Pieces in Good Condition*	*Cost of Each Sleeper*	*Cost of Fastenings* for Each Sleeper*	*Remarks*
42	Apr., 1933	May, 1933	1,687-1,700	1/70 grade 1,000′ r. curve	16 crack in middle 3 damaged at ends, still usable	Center bound and centrifugal force	23	$7.57	$4.91	See Fig. 1—Weight 226 kg.
68	Oct., 1933	Mar., 1934	,,	1/70 grade 1,000′ r. curve	22 crack in middle 9 damaged at ends, still usable	,,	37	7.57	4.91	
2	Apr., 1933	Dec., 1933	2,170-2,179	1/33.33 grade 600′ r. curve	nil	—	2	7.57	4.91	
17	,,	,,	In the Shihfusze Tunnel	1/33.33 grade 600′ r. curve	All crushed by train	Train derailment	nil	7.57	4.91	
11	,,	,,	2,223-2,230	1/33.33 grade 700′ r. curve	6 crushed at rail seats, not usable	Unsound concrete due to defective materials or poor workmanship	5	7.57	4.91	
30	Oct., 1933	May, 1934	2,278-2,281	1/32 grade 600′ r. curve	6 crushed at rail seats, not usable 15 crack in central portion, still usable	Cause of crushing, same as above, cause of crack, center bound	9	7.57	4.91	
20	Sept., 1935	Sept., 1936	2,062-2,065	1/30 grade tangent	nil	—	20	6.86	3.90	See Fig. 2—Weight 216 kg.
20	,,	,,	2,123-2,126	1/33.06 grade tangent	,,	—	20	6.86	3.90	
20	,,	,,	2,210-2,214	1/33.33 tangent	,,	—	20	6.86	3.90	
9	,,	,,	2,250-2,252	1/30 grade tangent	,,	—	9	6.86	3.90	
24	,,	,,	2,271-2,274	Level tangent	,,	—	24	6.86	3.90	

* Fastenings include clips, nutlocks, bolts and nuts, washers and planks under rail seats, but not steel tie plates.

Electricity Supply in China

CONSIDERABLE progress has been made in China in the past few years in the production and distribution of electricity in China. This is particularly true in the large centers in which industry is concentrated and which consume about 80 per cent of all the power used in the country. Probably the main reason for the improvement is the institution, in 1928, of a National Construction Committee intended to supervise the electrical industries in all China.

The situation that this committee found was not an encouraging one. Free distribution of electricity amounted to 70 per cent of the total used in Canton, for example, whilst in Peiping and Tsinanfu the figure reached 60 per cent. Thefts of electricity also were frequent, especially in the systems operated by Chinese firms, whilst difficulties of transport for fuel and material, a slavish following of routine methods and the practice of building with the cheapest equipment obtainable interfered with the proper operation of the plants.

The action of the Committee was in the first place directed to obtaining a concentration of the plants. Considerable numbers of power users preferred to run their own stations rather than use the distribution companies' services, and even where these existed the size of the systems was on the whole very small. Thus as late as 1935 there were only twelve stations with a capacity of over 10,000 kw., whilst thirty-six were rated at between 1,000 and 10,000 kw. On the other hand there were ninety-six plants with capacities between 100 and 1,000 kw., and 316 had a capacity of less than 100 kw. This concentration is, of course, slow, but is being carried on steadily.

The Committee has also built a testing laboratory for the examination and approval of all material before it is installed, and has standardized both material and system of supply ; the standards for the latter are 50-cycles and 220/380-v., and these standards are now applied in about 80 per cent of the Chinese distribution systems. Another action of the Committee which has contributed to encouraging electrial development is the enforcing of rate cuts when profits rise above 25 per cent on the invested capital. The power distribution franchises have also been standardized with grants for a period of twenty years, and the Government is empowered to take over the plant at the expiration of the franchise. At Hangchow and Chishuyen the systems have already been taken over ; in the latter town this has enabled the free distribution of electricity to be reduced to 15 per cent. Government plants are not always free from difficulties, however. For example, at Canton the Committee found in 1931 that only 30 per cent of the electricity distributed was being paid for, and this at the rate of only 20 cents Chinese per kw.

It is estimated that 20 million h.p. of hydraulic energy is available, but only a very small part of the electricity produced is from water-power sources—about one per cent. In 1934 there were eight privately owned and two publicly owned hydro-electric plants in the country with a total capacity of only 2,200 kw. Compared with this there were seventy-eight privately owned and ten publicly owned steam stations with a capacity of 476,000 kw., and sixty-two private and two public plants with a capacity of 64,000 kw., operated by combustion engines.

There are two main reasons for this. In the first place the cheapness of labor and the widespread distribution of coal in China makes this fuel very cheap. In the second, the investments involved in the construction of dams and important hydraulic works for an uncertain financial return, as well as the difficulties in the way of constructing high-voltage lines has, so far, discouraged enterprise in this direction.

Another problem which the Chinese distribution industries have to face is the securing of consumers. Outside of the large centers where electricity is used much as anywhere else for lighting, power and domestic uses, there is little industry of any importance. The small plants find it cheaper to employ manual labor rather than electrical power, so that lighting remains the only available outlet for electricity. Traction is out of the question, as the narrowness of the streets in the smaller centers would not permit the installation of lines. As a result, in many small towns the plants are started up at nightfall and stopped at a definite hour of the evening or at dawn.

In the large centers development is more normal. This can be seen from the following figures.

Town	*No. of Plants*	*Capacity in 000 kw., 1934*	*New installations, 1935*	*Production 1934 Million kwh.*	*Production 1935 Million kwh.*
Shanghai	7	247	40	1,031	993
Canton	1	24	30	89	87
Hankow	4	23	—	59	65
Tientsin	5	37	—	59	59
Tsingtao	1	14	15	44	47
Peiping	3	24	15	48	45
Nanking	1	14	10	24	32
Hangchow	1	20	—	26	29

The possibilities of China in the direction of electrical development can thus be seen to be enormous. Outside of Shanghai, which stands in a unique position in the country, there is still an almost undeveloped industry. The activity of the National Construction Committee in encouraging the growth of larger plants with a capacity in the neighborhood of 10,000 kw. seems, for the moment, to be the best solution. However, until considerably more social and economic improvement takes place in the interior of the country so as to make it financially possible, the development of the hydraulic power resources will not be possible.—*Electrical Review.*

Some Aspects of Track Maintenance on the Peiping-Suiyang Railway

(Continued from page 280)

year. The second method consists of keeping the ballast level in the cribs 3 or 4-in. below the base of rail, so that the drifted sand or snow may be blown through the clear space between the rail and the ballast, thus reducing the chance of being accumulated between the two lines of rails. The third way consists of planting rows of willow trees on the windward side at a suitable distance from the affected track, and inclined at a suitable angle with the direction of the line, thus forming a barrier to check the advance of the drifted sand or snow.

While many engineers' sections occasionally report some rail failures, the section engineer at Kalgan has the largest number of failures every year. In the year 1936, 34 pieces of 85 lb. rails on the main line and 19 pieces of 60 lb. rails in the sidings had to be replaced, due to breakage in one way or another. These rails fail not only in the winter, but also in the summer. The fissures or cracks may be either longitudinal or transversal, usually at a distance of 2 or 3-ft. from the rail end. The 60-lb. rails which have been found broken are mostly located in side tracks partly buried in rubbish, earth or locomotive cinders, but it is rather hard to explain why rails in the main-line tracks at or near Kalgan should fail more than those in any other section. This problem still remains to be solved.

No doubt there are many kinds of work which should be done with a view to bringing the condition of our tracks up to a better standard ; but our financial condition do not permit us to do what our Maintenance Engineers would wish to. What is described above will serve to show the probable maximum amount of work that can be done under the present circumstances.

Philippine Gold Production Increasing

Immense Gold, Chrome, Iron Deposits Possessed by Philippine Islands

IMMENSE Philippines resources in gold, chrome, iron ore, and other minerals were reported in a United States tariff commission analysis of Philippine-American trade. New gold production already occurring at the rate of $20,000,000 annually, preliminary development of chromite ore deposits estimated to contain 10,000,000 tons in a single area, and a reported survey of an iron deposit on the island of Mindanao containing 500,000,000 tons of ore with average ferrous content of 54 per cent, are among the highlights in Philippines mining activity described in the report.

The tariff commission study, which contains the first officially sponsored review of Philippines minerals resources issued here for some years, also reports the existence of silver, copper, and manganese deposits in the islands. Plans are being made, it was said, to develop copper in the island of Panay, Sulu Archipelago.

The report dealt generally with the economic relations between the United States and the Philippines, in the light of probable effects of the Tyding-McDuffie Independence Act which imposed restrictions on various commodities produced in the islands, particularly sugar, coconut oil, and cordage.

Attention to Minerals

Expert attention was specially interested in the minerals situation, however, for the reason that mining affords one of the best fields for the diversification of insular economic system, and the production of commodities relatively non-competitive with articles produced in the United States.

The report pointed out that regardless of restraint on other imports, the Philippine gold "will undoubtedly continue to be acceptable without serious restrictions either in the United States or elsewhere."

In 1935, gold was the third export commodity of the islands, exceeded only by sugar and coconut products.

Statistics showed that Philippines gold production developed slowly until 1929 when it amounted to $3,370,000, the previous record for a single year having been $1,946,000. Production in 1935 was about $15,000,000, and United States treasury figures issued after preparation of the tariff commission study reported the 1936 output at $20,980,855.

Practically the entire gold output is shipped to the United States. The bullion is partly refined when shipped, and the refining is completed by the United States mint. Ultimate production of the islands was not forecast by the tariff commission, but it was pointed out that mill capacity increased from 500 tons daily in 1930 to 4,500 tons in 1935, with new installations indicating daily plant capacity of 7,400 in 1936.

The commission said that a chromite ore deposit located near Masinloc, in Zambales Province, Luzon, is shown by surveys to contain over 10,000,000 tons of ore, making it the largest known body in the world.

The deposit has a relatively low chromic oxide content, averaging 35 per cent, "but, because of the size and location of the deposit, it is believed that exploitation of the deposit may be undertaken profitably."

Four Iron Ore Deposits

Four iron ore deposits have been discovered, but thus far only one, at Mambulao, Camarines Norte, is developed commercially. Exports totalled about 300,000 tons in 1935 and were expected to be 450,000 in 1936. The principal market for this ore is Japan.

Deposits of silver, copper, and manganese also exist in the Philippines, according to the report, which said that silver also is produced as a by-product of the gold industry.

"Copper deposits of considerable size have been located in the mountain province of Luzon, but inaccessibility, low grade ore, and until recently, copper prices, have combined to retard their development. Plans are being made to develop deposits of copper in the island of Panay, and in the Sulu Archipelago.

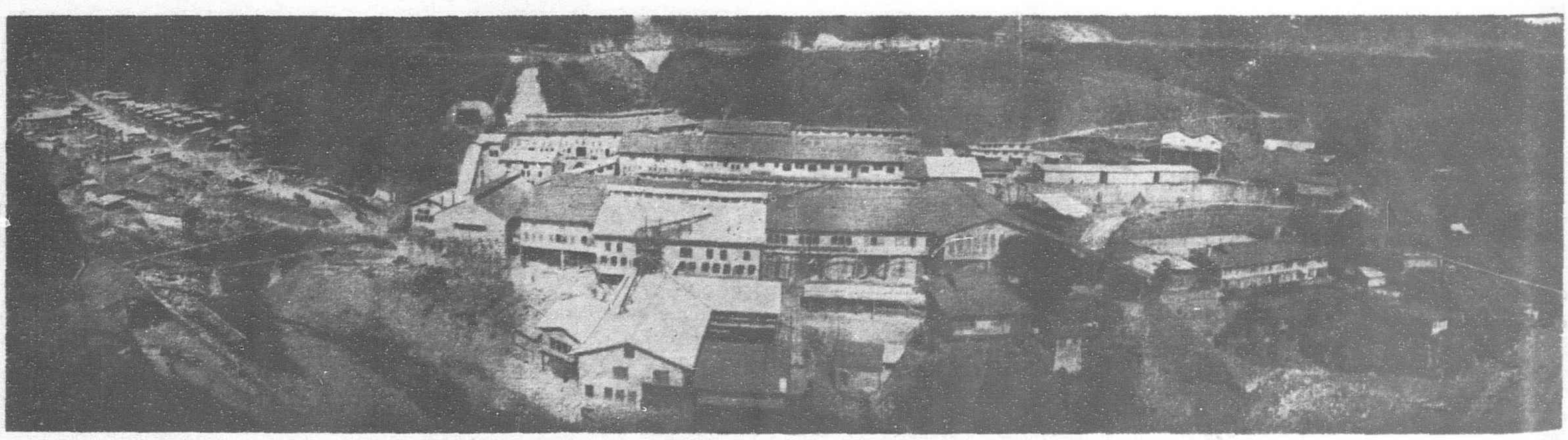
California, with 1,042,915 ounces comes first under the American flag in gold production, the Philippines second, South Dakota with 589,299 ounces, third, and Alaska with 510,982 ounces, fourth.

Fifty per cent of the Philippine production came from the Haussermann operated mines of Benguet Consolidated, Balatoc, Ipo, and Cal Horr. Other producers are Antamok Goldfields, Masbate and I-X-L Mining under Soriano interests; Itogon, San Mauricio, United Paracale and Suyoc Consolidated under Marsman; Demonstration, Salacot and Benguet Exploration under Ralston management; Atok Gold, Big Wedge and Baguio Gold Mining. Placers include Coco Grove, Tambis, and Agusan Gold, none of which are big contributors.

Beginning with a few ounces, the Philippine gold production has climbed steadily since 1932, as aforesaid, when the increased price in the value of gold from $20.67 to $35.00 per ounce enabled new companies to be launched and low grade properties to be brought to production stage on the seventy per cent gain. Several mines of importance have been developed since this time.

The big gold producers are in the Mt. Province and Paracale districts with Masbate, Surigao and Bulacan containing producing mines. Fissure vein and lode in andesite and diorite rocks is said to contain the gold ore of commercial quantity. In most lodes in the Philippines gold is associated with silver and sometimes copper. These are separated from the gold as by-products, but are not mined separately. The placer gold, which occurs in the same districts as the lode, is associated with platinum in such small quantities as not to justify its separation.

Mineralization extends to other territories in the Philippines which are now being determined by extensive exploration. Mountain Province formerly held the greatest interest for gold prospectors, but Paracale is now of importance with other districts commanding attention.



A bird's eye view of the Balatoc Gold Mine, the greatest in the Islands

Chromite will probably become a very important mineral in the Philippines as several large chrome deposits are being developed. Benguet Consolidated has already started shipment of high grade ore from the Florannie deposits in Camarines Sur and early this year will make shipments to the United States and Europe from the Zambales chrome deposits operated by them for Consolidated Mines, Inc. Many smaller chrome deposits are now being brought to production stage, one of which, located near Santa Cruz, Zambales, is under Marsman management. Other districts said to contain chromite ore of commercial value are in Ilocos Norte, Pangasinan, Dinagat Island and Antique.

Copper is now receiving attention of mining officials and a mine in the Suyoc-Mankavan district is to be brought to production. The gold alone in this deposit may justify the exploitation of the deposit. Capiz is being explored by Montilla interests for copper while other regions which may produce copper of commercial value include Benguet. Mindoro, Marinduque, Batangas, Masbate and Pangasinan.

Iron ore has been shipped to Japan in considerable quantities by the Philippine Iron Mines of the Paracale district. In Surigao iron deposits are held under reservation by the government and are sufficient to supply local needs for several hundred years. Samar, Camarines, Bulacan and other districts are known to contain iron ore, but are in the early exploration stages.

Manganese ore is found in Camarines Sur, Antique, Ilocos Norte, Tawi-Tawi, and Palawan. The deposits in San Jose, Antique, are of considerable importance though of low grade. Attempts to develop this district are now being made by several commercial firms.

Two views of mining villages in the gold districts of the Philippines

Ancient Igorot Mine Still Yields Gold

There is an ancient Igorot gold mine in the Suyoc district, Mankayan, Benguet, that has an interesting story behind it. The mine has attracted no little interest among mining men who never fail to visit it when they happen to be nearby.

In 1916 V. E. Lednicky, a mining engineer then in the government service, visited the famous mine. He wrote a history of the property and published it in the *Philippine Journal of Science*, Vol. XI, a publication of the Bureau of Science.

The Palidan-slide Mine is a community property of the Suyoc Igorots and has been so from time immemorial. The exact date when the mine was opened is not known "as the Igorots divide their time vaguely into generations." It is believed the mine was worked by at least four generations of Igorots before the Spaniards came to the Islands. The Igorot chiefs of the four generations were Alaban, Gislang, Wasawas, and Witawit. The last one was alive when the district was placed under the command of the first Spanish military governor.

The *comandante*, according to a historical account, attempted to wrest the mine from the natives, but the governor-general listened to the protest of the Igorots and thwarted the attempt by recognizing them as the rightful owners of the property. According, the *comandante* allowed the natives to work but managed to buy their gold at 10 pesos per Mexican peso weight (27.07 grams) of gold. The dealing continued until the insurrection of 1895. Throughout that year the natives mined gold under duress for the insurrectos. The amount of metal extracted is not known.

Upon the advent of the American regime the former Spanish *comandante* again tried to take possession of the mine under the concession law. The application was disapproved. The natives continued working the ground.

In 1903, C. E. Petit, upon request of leading Igorots, registered the property for his six Igorot friends and himself under the American mining law. The legal registration did not stop the natives of the district from mining on the property, for they still regarded it as community mine. Petit, getting no benefits from the mine, years later decided to lease his share for 15 ounces (466.5 grams) of gold paid by the mining natives.

The Palidan slide, about 102 kilometers north of Baguio and close to the Bontoc road, is an immense cavity washed out around the Palidan and Cadangan ravines approximately the shape of an inverted elliptical cone whose major axis bears north 60 degrees east, Mr. Lednicky wrote. "The opening is approximately 620 meters long and 430 meters wide. The vortex (deepest point) is very close to the central edge of the north-west quarter of the ellipse at the point where the Cadangan and Palidan ravines unite. This point is about 200 meters below the average rim of the slide.

"The cavity is continually being enlarged by the heavy tropical rainfall, which washes away the soft material very rapidly. The Igorots aid nature in performing this work, as they make excavations in the sides and divert channels of water in order to wash off the surface material and to expose the rich stringers of gold ore.

"The geologic formation of the slide is difficult to determine exactly. The lower part is composed of the solid diorite base which is found underlying all the region. The diorite shows rapid weathering on exposure but is firm enough to form steep walls for the swift-flowing streams which cut through it. The rock of the upper portion seems to be the same diorite, very badly decomposed. It is so much altered that it is impossible to make any excepting megascopic examinations. It is porous and is very highly impregnated with iron sulphides. The surface exposed to the air decomposed very rapidly and allows of excessive erosion.

"The upper rock has been very heavily silicified in altering, and masses of quartzose material are common. It shows a great network, of little veinlets or stringers of quartz which are the results of a secondary infiltration into cracks and crevices, suggesting dehydration of a large mass rather than dynamic causes. These little veinlets are usually an indication of gold values.

"Wherever the veins are wider they represent a banded structure of quartz and a bluish white kaolin known by the natives as 'pitoc.'

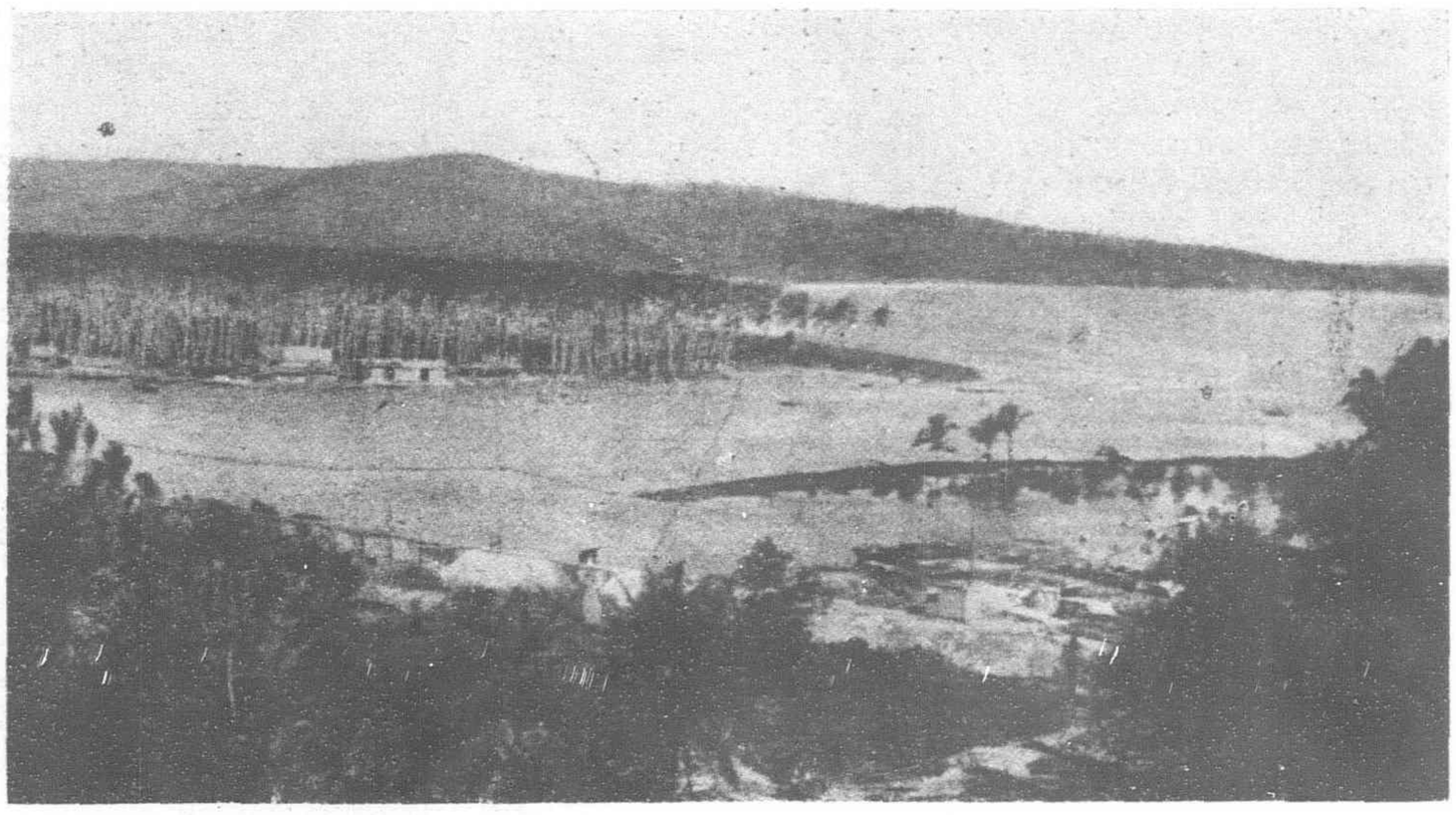
"A fibrous variety of gypsum, white in color and with a shiny luster, and fibers that usually curved and transverse to the veins alternate at time with the kaolin. It is an indication of rich gold values and is very closely observed by the Igorots. Several kilograms of gold are said to have been removed from a single pocket in the gypsum.

"Exposed in the slide are several rather prominent veins, which have been worked for gold by the Igorots. The most important of these, the Palidan and Cadangan veins, have produced the greatest amount of gold within the past few seasons. The gold occurs free in the ore in rather fine particles. The ore is very similar in color in the iron sulphide and is distinguished with difficulty by any one not well acquainted with it. The natives who have been handling the ore since childhood recognize the free gold at a glance, the rapidity with which they judge a piece of ore being almost unbelievable.

"The mining season at the Palidan lasts from one to six months and from 40,000 to 80,000 pesos worth of gold is recovered from the ground in that time. The miners start work immediately

after one rainy season and continue until the next, when the ground becomes subject to slides and consequently dangerous. About two hundred men, women, and children are actively employed in the work. Of these, the majority are women, the rest are children, and a small number are men.

"The method of working is that used in other countries known as 'booming.' In the smaller veins and in the beginning of the Palidan slide, dams have been built across gullies to form reservoirs, which are allowed to fill either with rain water or water from small creeks. As soon as the reservoir is full, the gate is opened and the flood of water is allowed to tear away the overburden from the vein. Between washings the native workmen place timbers or make such excavations as they consider necessary for more rapid cutting. The dams are usually built of sod, laid flat and reinforced with poles driven into the ground on either side.



The River and Bay at Paracale, said to contain immense gold deposits

"The gate is unique and very efficient. It consists of a rough wooden frame, several meters long and about half a meter wide set upright into the sod dam and luted into place with a very plastic clay. To the inside of the uprights and bottom of the frame are nailed strips, or cleats, against which the door is pressed by the force of the water.

"The door itself is a thick, hewn pine board which fits loosely in the large frame. Its edges are beveled at an angle at about 60 degrees to its face. The upper part of the door is tied to the top of the frame by a piece of bejuco to prevent its being carried away when the door is opened. To operate the reservoir, the door is placed in position with the wider face pressing against the cleats. With a pointed stick, a long water-soaked rope is forced around into the wedge-like crack left between the frame and the door. This seals the opening so effectually that scarcely a drop of water escapes. The pressure of the water tends to tighten the packing, and there is little danger of its coming out unexpectedly.

"To open the gates against water pressure, the operator simply pulls out the rope packing and pries against the top of the board with a stick. The water pressure does the rest. It takes less then one minute to replace the gate after the water has run out.

"In the Palidan slide the working has become so large and is so favorably situated that the rains of the wet season do most of the work necessary in washing off the overburden. As soon as the rainy season is safely over, the natives go into the slide and examine it for veins.

"When rocks, too hard for hand spunds are encountered, and when powder is not available, fire and water are used. This method is very efficient though slow. As the working is deepened, stulls are put in which achieve the double purpose of holding up the hanging wall and of serving as perches for the women ore storters. The stulls are pine, about 20 centimeters in diameter with regular hand-boards and wedges. They are furnished and put in by men, this being the only work in which women do not seem to take a leading part.

"In order to accommodate the one hundred and fifty to two hundred persons, and for convenience in handling ore, the exposed vein is divided into sections which are worked by different sets of individuals. Each set has its preferred right in the section to which it is assigned and conducts mining operations to suit itself. This procedure allow for a diversity of opinions and leads to better mining. In each open stope the actual mining is done by a few men and women who wield the spuds, and who, of course, have first pick at any rich pockets of ore. They take turns at the face, so that all have an equal chance. Immediately back of the miners are women and children. The hats the women wear serve a double purpose—as a protection against falling rocks and as ore baskets. They are made of bejuco and bamboo with small square bottoms and wide flaring sides. They vary in width from 30 to 40 centimeters and are about 12 centimeters deep. The women and children catch the ore in their baskets as soon as it is broken down. They examine it once by the dim pitch-pine light, and if it is extra good they cover it with another basket and send it to their relatives on the surface, who inspect it and sort it more carefully. If it is nothing out of the ordinary, they pass it back, this procedure being followed until it has been passed from hand to hand by the dozens of women packed in the stope.

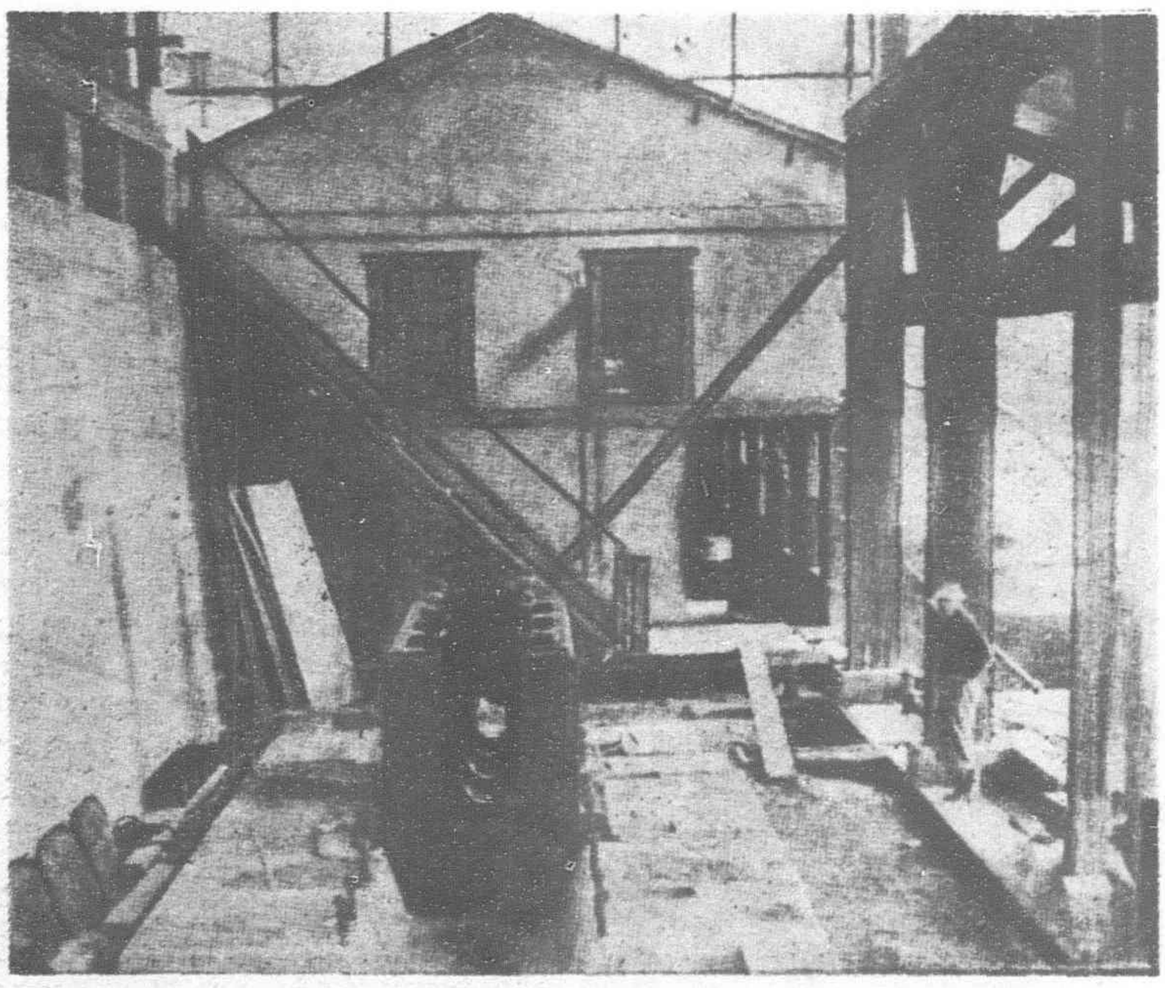
"What is left when it reaches the surface is given a final inspection and is dumped or saved.

"The waste is thrown back in those parts of the stope which have been worked out and bulkheaded off from the rest of the stope so that the actual open space is small and few accidents from caving take place. Since the ore is snatched away so rapidly, the miners are never in need of muckers, and as the appointed timbermen keep the stulls advancing with the face or bottom, the miners' task is an easy one. A white man could never work under the same conditions. The air is very stale, and the odors from the women packed immediately back of the miners and the sooty smoke from the pine torches make it especially disagreeable. At times, when good ore is coming out, the women are so tightly jammed in the stope that it is necessary for the miner to walk out over their shoulders.

"In case of an exceptonial strike it is customary for the women to fight and pull each other's hair to get advantageous positions. Fortunately no one has ever been killed in one of these fights. The women and children are very expert in hand picking and can tell almost at a glance whether or not the specimen is of value. They look for free gold after moistening the rock with their lips. Although hundreds of pieces are examined in this way almost every day, there seems to be no transmission of communicable diseases nor sickness resulting from swallowing so much earth.

"The fine ore that is discarded and all the sulphide wash are concentrated and reconcentrated several times

(Continued on page 290)



Part of a new Diesel engine at Baguio Gold already in place in the new Power Plant Annex, waiting for its sister part

Chemical Industry in Japan

Its Steady Development Typifies Growth of all Major Industrial Activity

(From the 1937 Supplement of "The Osaka Mainichi")

THE development of the Japanese chemical industry, in recent years, has been phenomenal. It has annually increased in importance among the various key industries of the Empire.

The rapid advance of the chemical trade can be seen in the following basic figures. In 1934, the total invested capital was Y.1,355,000,000, accounting for 5.1 per cent of the aggregate capital invested in all the industrial firms of Japan. The number of chemical factories in the same year aggregated 4,300, which is equivalent of 5.3 per cent of all the industrial plants in Japan.

The number of workers employed was 192,000, forming 8.88 per cent of all the industrial workers of the country. The annual production value was Y.1,514,000,000 (approximately six per cent of the total value of the nation's industrial production).

The value of Japan's chemical exports reached the large total of Y.206,000,000, approximately 6.6 per cent of the value of all the export trade of the Empire.

INVESTED CAPITAL, ANNUAL PRODUCTION

(Unit, Y.1,000,000)

	1934	*1933*	*For all Industries*
Paid-up capital ..	1,355	807	21,126
No. of plants	4,313	4,013	80,311
Employees	192,000	164,000	2,163,000
Production value ..	1,514	1,300	9,390
Export value	206	—	2,135

These figures indicate vividly the great advance of the chemical manufacturing industry in recent years, and also the annually increasing importance of the industry in the national life.

If the chemical industry is divided into its variegated departments and the capital invested in each is scrutinized, the following table results :

VARIOUS CHEMICAL INDUSTRIES

Classification	*No. of plants*	*Paid-up capital*
Drugs, medicine ..	579	Y. 94,930,215
Industrial chemicals	232	117,762,022
Dyestuffs	32	21,666,350
Paints	206	27,707,750
Soap, cosmetics ..	241	32,335,380
Matches	44	8,498,800
Fats and oils.. ..	217	97,882,000
Rubber	343	36,051,918
Celluloid	47	15,274,200
Rayon	24	282,313,000
Paper	218	251,542,650
Artificial fertilizers ..	187	293,400,866
Others	230	76,201,808

It is thus clear that the arificial fertilizer industry leads all others with an invested capital of Y.293,400,000, followed by the rayon industry (Y.282,000,000), the paper industry (Y.251,500,000), and the industrial chemical manufacturing circles (Y.117,700,000).

If the total invested capital is divided by the number of plants, the average capital per factory is as follows : First, the rayon industry with Y.11,860,000 : second, the artificial fertilizer industry with Y.1,560,000 ; and third, the paper-making industry with Y.1,150,000.

As to the business conditions of the chemical industry, it must be particularly noted that during the 1929-1931 depression the industry suffered greatly, with profits dwindling to a low figure. However, with the recent revival of business, the chemical industry has shown a surprising upward trend, its rising tendency being actually more vigorous than that in other quarters, when one considers the fact that it felt the depression more than they did.

Nevertheless, one must not forget that not all the departments of the chemical industry have seen the same degree of recovery. Whereas the fertilizer, the industrial chemical, and the celluloid and rayon manufacturing firms have shown a stupendous advance in recent years, others, such as the match-making enterprises, are still suffering from business stagnation.

Conditions of Production

As the table to follow indicates, the production conditions in the chemical industry of Japan during 1929 and 1931 were gloomy. During that period, the other industrial circles were also suffering from bad business and this accounts for the annual increase in the ratio of chemical production to all other industrial production, it rising from 14 per cent in 1929 to 16.6 per cent in 1933. The ratio fell back to 16.1 in 1934.

The actual value of production, however, increased from Y.827,000,000 in 1931 to Y.1,300,000,000 in 1933, and to Y.1,510,-000,000 in 1934. From these facts, continued development upward of the chemical business can be forecast.

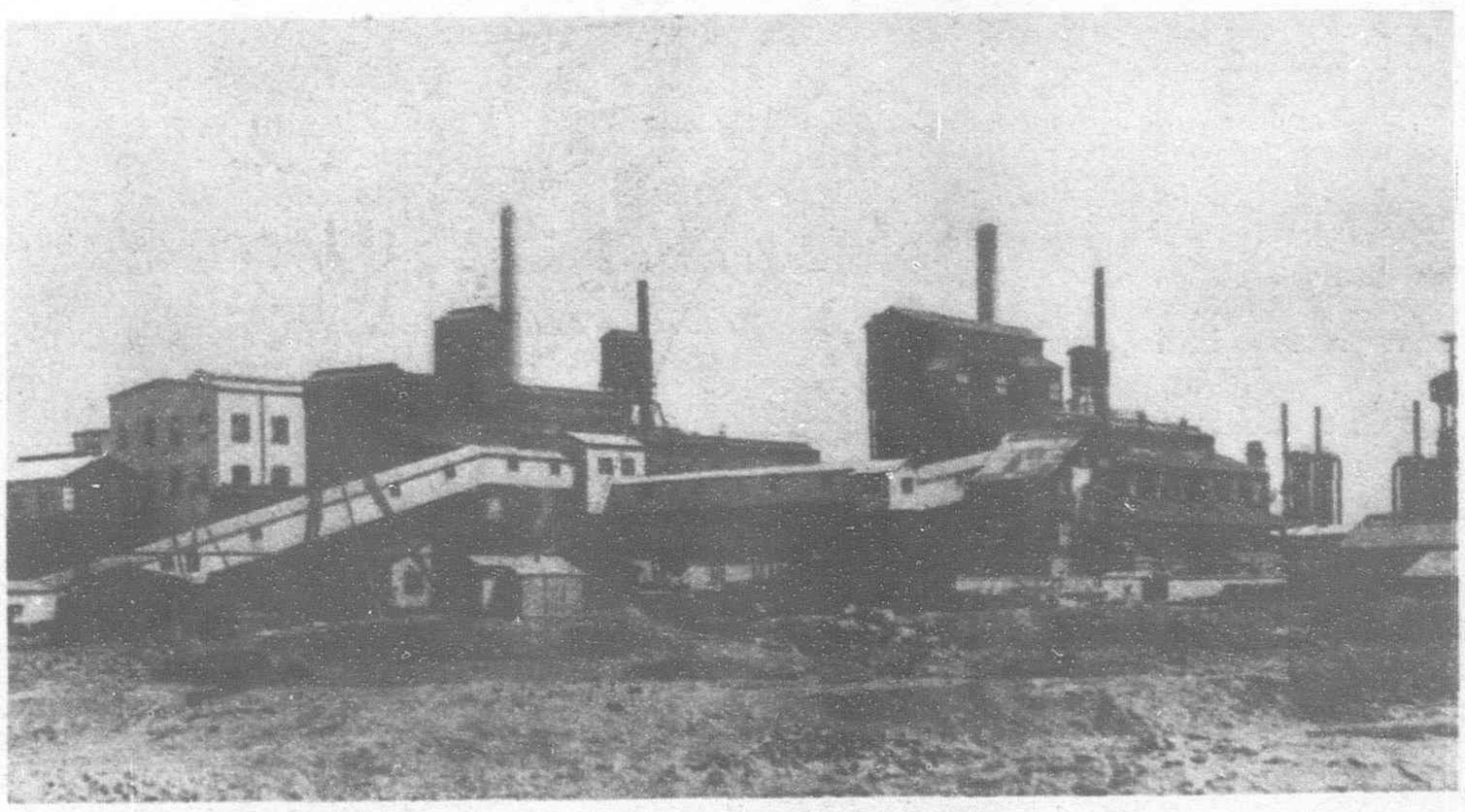
RATIO OF CHEMICAL INDUSTRY PRODUCTION TO TOTAL OF OTHER INDUSTRIAL OUTPUT

(Unit, Y. 1,000,000)

Year	*Chemical production*	*Processing costs*	*Total value*	*Compared to all industry total per cent*
1929	1,077.6	2.4	1,080.0	14.0
1930	924.0	1.3	925.3	15.5
1931	825.5	2.2	827.7	16.0
1932	957.0	4.4	961.4	16.1
1933	1,300.3	2.6	1,302.9	16.6
1934	1,514.8	3.7	1,518.5	16.1

Note : Figures are from the Commerce Office factory statistics.

In the table below is shown the annual production value in the various classifications of the chemical industry.



Sulphate of ammonia factory at Ube city, Yamaguchi prefecture, now enlarging its plant

From the table it is evident that the rayon industry leads all others in the value of annual production, as well as in the ratio of yearly increase. The increase was more than Y.100,000,000 between 1929 and 1934, the ratio of increase being 323 per cent.

Although not comparable with the rayon industry's increase of production value, the artificial perfume industry showed an expansion factor of 440 per cent during the same period.

CLASSIFIED PRODUCTION VALUE

(*Unit, Y.1,000*)

Types	*1929*	*1931*	*1933*	*1934*
Drugs, medicine ..	78,093	60,063	75,584	88,864
Industrial chemicals	116,269	113,553	205,111	214,535
Dyestuffs, mediums..	15,856	12,717	34,041	35,938
Paints, varnishes ..	39,203	34,341	52,615	54,900
Soaps, cosmetics ..	70,571	60,215	72,889	80,517
Illuminants	8,666	6,437	15,501	19,086
Mineral oil	37,291	43,035	78,012	91,208
Animal, vegetable oils, fats, tallow ..	50,524	30,647	50,781	79,506
Rubber	76,599	56,105	86,705	103,218
Paper, pulp ..	211,250	145,808	175,925	218,447
Celluloid	19,508	10,404	24,202	27,644
Rayon	45,393	50,696	104,072	147,548
Photographic goods..	2,437	2,970	4,717	8,115
Fertilizers	177,774	135,520	172,486	186,860
Leather	17,500	12,707	22,802	25,522
Vegetable, volatile oils	15,146	11,183	14,533	15,720
Tannin extract ..	—	59	148	196
Perfumes	893	1,143	1,822	4,052
Resinous goods ..	373	754	2,287	—
Phonograph records	6,030	6,154	11,640	13,220
Vulcanite fiber ..	1,132	731	1,450	1,257
Paste, mucilage ..	3,669	2,976	4,982	4,656
Abrasives	1,687	1,010	2,616	3,683
Carbon products ..	1,616	1,574	3,396	6,585
Coke	25,710	16,569	21,048	41,231
Briquets	4,351	5,505	11,154	12,819
Charcoal	691	202	132	119
Others	26,351	12,176	23,027	25,811
Grand total	1,077,314	825,082	1,299,656	1,514,886

Note : Figures are from the Commerce Office factory statistics.

The table does not include factories operating under the mining industrial law nor the match manufacturing plants.

The preceding table thus clearly indicates that the paper manufacturing and wood pulp industry leads all the other departments of the chemical enterprise with an annual production of Y.218,000,000. Industrial chemical manufacturing comes next with Y.214,000,000.

Then follows artificial fertilizer production with Y.186,000,000 ; rayon production with Y.147,000,000, and rubber goods production with Y.103,000,000.

These figures present a clear indication of the degree of development achieved by the various branches of the chemical industry in Japan.

Production Details

(*1*) *Industrial Chemicals.*—Industrial chemical manufacturing forms a fundamental division of the entire chemical industry. In the initial years of its development this department lagged behind, but in recent years its advance has been phenomenal. It has grown at a rate many degrees quicker than other enterprises within the chemical industry.

The principal industrial chemicals manufactured in Japan are : sulphuric acid, hydrochloric acid, nitric acid and other inorganic acids ; soda ash, caustic soda ; ammonia ; oxygen ; carbide, bleaching-powder ; glycerine ; magnesium carbonate ; and others.

The annual production of these chemicals has been showing a constant increase, particularly ammonia, soda ash, nitric acid, caustic soda, and magnesium carbonate.

It may be mentioned here that the manufacture of the inorganic acids developed early in Japan. On the other hand, the production of alkali chemicals was slow to establish itself, due to the difficulty of obtaining the ample supply of salt necessary for their production.

The recent growth of this department of the chemical industry has, at last, eliminated the serious handicap under which Japanese industries labored. The chemical manufactures of Japan have advanced not only quantitatively but also qualitatively in recent years, consolidating the industrial position of the Empire.

INDUSTRIAL CHEMICAL PRODUCTION

(*Unit, 1,000 metric tons*)

Classification	*1929*	*1933*	*1934*
Sulphuric acid	1,146	1,614	1,745
Hydrochloric acid	34.8	67.6	80.5
Compounded	7.3	34.6	43.7
Others	27.5	32.9	36.6
Nitric acid	15.5	56.9	65.4
Compounded	2.5	53.9	61.7
Others	12.6	3.0	3.7
Soda ash	43.6	272.2	170.6
Caustic soda	57.6	131.7	177.7
Carbide	216	217	254
Bleaching-powder	50.8	61.6	66.1
Acetic acid	6.0	6.5	8.2
Compounded	1.8	6.0	7.9
Others	4.2	0.5	0.3
Glycerine	4.3	6.2	6.9
Magnesium carbonate ..	5.2	17.4	16.2
Oxygen	18.3	39.3	36.5
Ammonia	2.2	108.6	73.1

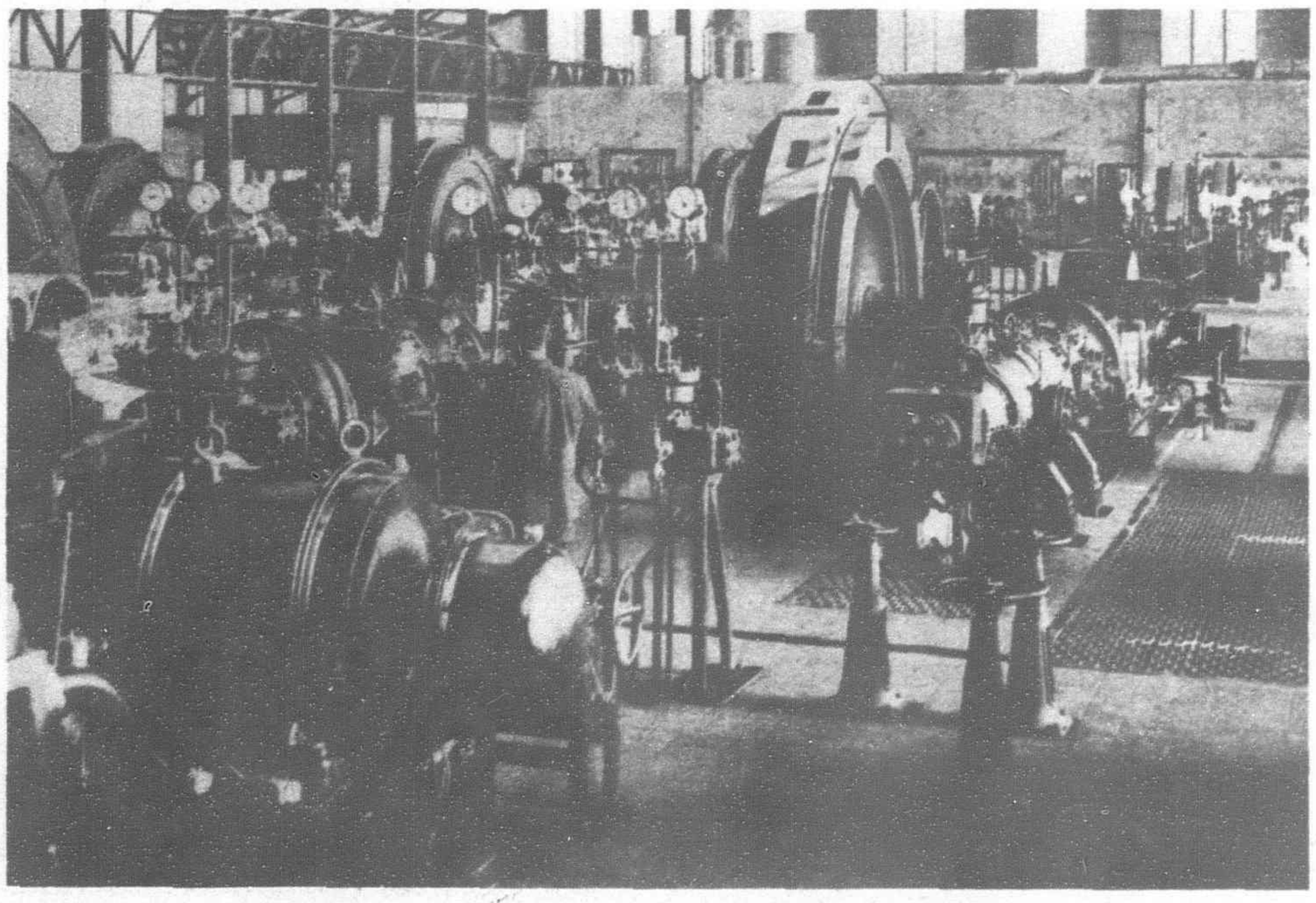
The above table shows, in round figures, the great increase in the production of nitric acid, the total production weight increasing 24-fold between 1929 and 1934.

Among the recent additions to the growing industry is the rapidly increasing production of potassium chlorate, acetate, methanol, absolute alcohol, formic acid, and oxalic acid.

(*2*) *Pharmaceutical Chemicals.*—In the pharmaceutical chemical industry, rapid production growth has been shown in the department of ferments and drugs for internal use. The coal-tar base and alkaloid base drugs have also seen increased production.

Aspirin, antipyrin, saccharine, salicylic acid, quinine, codein, strychnine, adrenalin, glycerine, formalin, and hydrogen peroxide have shown special increase in production of late.

Although the Japanese pharmaceutical chemical industry has yet some distance



Interior of the Ube city sulphate of ammonia factory

to go before it reaches the highest international level, the recent advance presages the attaining of that level in the not too distant future.

(3) *Dyestuff Industry.*—The sulfide base dyestuffs developed the earliest in Japan. The production in 1934 totalled 12,100 metric tons, comprising about 70 per cent of all dyestuff production. Direct dyestuffs, basic dyes, then follow in order.

The production of the various types of dyestuffs in Japan in recent years is as follows :

PRODUCTION OF DYESTUFFS

(*Unit, ton*)

Types	*1929*	*1933*	*1934*
Basic dyes	308.6	717.3	765.5
Direct dyestuffs ..	716.6	1,693.2	2,183.3
Acid dyestuffs	328.3	522.3	554.1
Mordant dyes	46.0	32.8	178.1
Sulfide dyes	7,408.6	11,815.9	12,144.7
" Kensen " dyes ..	66.2	659.4	1,753.0
Oil soluble dyes ..	325.1	817.8	1,056.5
Total	9,199.4	16,258.7	18,635.2
Mediums	8,962.9	10,072.4	8,319.0

As the table indicates, the increase in the volume of production has been constant. However, most of the dyestuffs manufactured in Japan are of the lower grade, though in some classifications, higher quality products have been achieved.

Thus, in comparison with developments in other nations, Japan has yet a considerable distance to cover. In short, the present state of things is principally due to the fact that most of the patents on dyestuffs are in the hands of foreign individuals and corporations.

(4) *Paints and Varnishes.*—Paint forms about one-half of the output of this chemical industry. Varnishes come next. The increasing output of insulating paints and non-corrosive paints, acetate, and butanol must also be mentioned.

The production of zinc white, paints for art use, and red lead lithopone is also considerable. Material for ink-making has, likewise, shown great expansion in production.

In the field of technical development, considerable progress has been witnessed, due to active research work by Japanese experts.

(5) *Celluloid Industry.*—Together with the rayon and paper industries, celluloid manufacturing has shown a great advance in Japan.

A detailed description of the paper and rayon industry will be omitted here, but the technical advance achieved in the celluloid industry in Japan is in keeping with the international standard. The qualitative improvement of the various celluloid goods and the perfection of non-inflammable celluloids and celluloid-like plastics by Japanese scientists deserve the attention of the world scientific circles.

(6) *Artificial Fertilizer.*—Turning to the artificial fertilizer manufacturing of Japan, it will be noted that mineral fertilizers hold the top position in volume. In 1934, the production was valued at Y.109,800,000, almost 55 per cent of the entire production of synthetic fertilizers.

Compounded fertilizers followed with Y.42,800,000. Then came vegetable fertilizers with Y.33,300,000, and animal fertilizers with Y.30,000,000.

The mineral base fertilizers not only lead in the volume of annual production, but also continue to expand in their yearly production. On the other hand, the vegetable base fertilizers are showing an annual diminution of volume.

FERTILIZER PRODUCTION

(*Unit, Y.1,000*)

Classification	*1926*	*1929*	*1934*
Animal fertilizers ..	24,010	19,619	30,026
Vegetable fertilizers ..	46,560	43,521	33,338
Mineral fertilizers ..	69,710	87,284	109,867
Compounded fertilizers	42,990	60,116	42,812
Others	200	217	87
Total	183,470	210,757	216,130

Note : The figures are from fertilizer statistics of the Agriculture Office. The table includes only those fertilizers manufactured under official authorization.

Types of vegetable fertilizers are : Bean-cakes, rapeseed residuum, and cotton seed residuum. The animal base fertilizers are : Sardine guano, fish-cakes, herring guano, and bone meal. The mineral base fertilizers are : Sulphate of ammonia, superphosphate, and nitrate of lime. Potassic fertilizers, which belong to this category, are produced in small quantities compared to the first mentioned types.

The fertilizer industry has not only increased the annual production volume in recent years, but also has improved its technical standard. New catalytics have been found for the synthesis of ammonia and acidifying equipment for ammonia has been perfected.

The hydrogen required for the production of sulphate of ammonia had been almost exclusively produced by the electrolytic process in Japan, but recently other methods have come into use, such as the utilization of water-gas, etc.

In the field of nitrate fixation, new processes have aided the development of the nitrate of lime manufacturing.

(7) *Oil and Fat Industry.*—Vegetable oil production is the most important of this division of the chemical industry. Processed oils come next. Vegetable oil accounts for 60 per cent of all the oil and fat production and processed oil 30 per cent. Both of these classes of oils are showing an increasing trend of production.

In the vegetable oil enterprise, bean-cakes form the most important item, with rapeseed oil coming next. In the animal oil section, fish oil and whale oil are the principal bases. Fats from cows and pigs show only a small production total in Japan. In the processed oil category, hard oils come first in volume.

The development of the Japanese oil industry has been stimulated by the perfection of the hard oil manufacturing process, the improved pressing process for soya beans, and the greater demand for soya bean protein.

* * *

This completes the detailed description of the principal divisions of the chemical manufacturing enterprise in Japan.

In addition, it may be mentioned that notable progress has been made in the following spheres : The production of synthetic scents in the perfume industry ; the utilization of camphor oils ; the production of resinoid plastics in the synthetic plastic industry, the manufacture of photographic chemicals, printing paper, dry plates, and films ; and the carbon manufacturing industry. Increases are seen in the output of all these lines.

Chemical Product Trade

The previous paragraphs show definitely that chemical manufacturing in Japan has shown constant development year by year. The annual production value has expanded, with the present trend being toward continued growth.

However, it must be mentioned here that the production in Japan is yet insufficient to meet all domestic needs. According to the trade statistics of 1934, the imports by Japan of chemical products exceeded the exports by approximately Y.90,000,000. But an encouraging tendency has been seen during the last three years in that the increase in the annual exports has been greater than the increase in the imports.

EXPORT, IMPORT OF CHEMICALS

(*Unit, Y.1,000*)

Exports	*1929*	*1931*	*1934*
Total amount	126,999	92,978	205,686
Percentage of all exports	6.3	8.3	9.6
Imports			
Total amount	303,042	210,713	297,060
Percentage of all exports	13.7	17.1	13.0
Import excess	176,043	117,735	91,374

The figures show that the export total for 1934, compared with that for 1929, was greater by 62 per cent. On the other hand the imports showed a decline by two per cent.

The percentage of chemical imports, compared to the total imports into Japan of all goods was 6.3 per cent in 1929, increasing to 9.6 per cent in 1934. The exports declined from 13.7 per cent in 1929 to 13.0 per cent in 1934.

The chemical products that showed an export excess in 1934 were : Rubber goods, rayon, celluloid products, soap and cosmetics, matches and explosives, paints, and drugs. In this division, the

export total showed an all-around increase compared to the figures of 1929. Some of the products turned from import excess to export excess.

The chemical products showing import excesses are: Oils and fats, tallow, pulp, paper, chemical fertilizers, films and dry plates, dyestuffs, etc.

Pulp and paper showed an export excess in 1929, but they joined the import excess column about 1931.

The trend in recent years is toward a greater import of chemical materials, and the increased export of processed or finished goods. Fully manufactured goods have shown a greater increase in exports than the semi-finished or partially processed chemical materials.

In the realm of chemical imports, the situation is exactly the reverse. Semi-finished goods and raw materials that cannot be obtained in Japan have shown a great increase, whereas fully finished goods have declined.

Comparing the 1934 figures with those of 1929, it is seen that in exports the semi-finished goods declined from Y.32,400,000 to Y.32,000,000, and fully finished goods increased from Y.56,800,000 to Y.114,500,000. In imports, the semi-finished goods and raw materials increased from Y.142,500,000 to Y.201,500,000 (a 40 per cent increase), and fully manufactured goods declined from Y.93,900,000 to Y.45,700,000 (a 50 per cent decline).

Future of Chemical Industry

There are several factors which have contributed to the recent expansion of the Japanese chemical industry, in spite of its being handicapped by a shortage of domestic raw materials. The factors are the increased exports, due to the lower yen exchange, the increased demand for domestic products to replace the high-priced imported products, and the great increase in the activity of the munitions industry in Japan. In addition, the general expansion of industries in Japan and the higher level of technical development are contributing factors.

The Japanese chemical industry at present appears to have a great future. The expanding domestic industries will increase the importance of, and the demand for chemical enterprises, and the growing Nippon export trade will carry the chemical industry exports along with it.

The Japanese chemical industry has shown great expansion in its production volume as well as in the qualitative improvement of its products, but it is yet lagging behind the standard seen in other major nations. Thus greater efforts must be made. As constructive suggestions, the following policies are mentioned:

(1) Consolidation of the basic chemical industry.
(2) Technical improvement of the industry in general.
(3) The promotion of enterprises that are particularly suited to Japan.

In addition, chemical enterprises that figure importantly in national defence and in times of emergency must be speedily consolidated so that Japan may be self-sufficient in that respect.

There is a considerable number of chemical research establishments in Japan, but organizations that specialize in the commercialization and practicalization of chemical inventions are few. It would be timely, if the government would extend subsidies for this purpose, as well as assist the research workers and inventors in chemistry.

All in all, in spite of the handicaps of the Japanese chemical industry, the annual increase of production and exports shown in recent years promises further and continued expansion in the years to come.

A Notable Demag Installation

(Continued from page 273)

wheels. The disadvantages of the so-called ceiling travelling cranes, which are dangerous in many respects and which Demag have always strictly declined to touch, are thus avoided.

The plan in Fig. 4, shows the directions in which the cranes run and the junction track, while the elevation shows the suspension of the cranes from the top flanges of the runways. It was only with a transporting system, such as this, that it was possible to cover the whole area of the pavilion by means of crabs which can travel from one crane to the other and on to the junction track over crossing pieces and by making ample use of crane and track interlocks.

One crane has a span of 50-ft. (15 m) and was suspended from three runways. The second crane has a span of 25-ft. (7.5 m) and is suspended only twice, and, with the help of the junction track, it enables corners of the buildings to be reached which could not be served hitherto by standard overhead travellers. It would also have been possible without further ado to have spanned the entire pavilion with just two suspension cranes suspended at three points, because, when employing suspension cranes, any width of building can be spanned simply by suspending the cranes at several points.

The cranes can thus be suspended not only at two or three points, but also at four or even five points, all according to the width of existing halls or that of halls still to be erected. The low deadweight of these suspension cranes with their runways for a carrying capacity of two tons was also of decisive importance for their employment in the "Stahl und Eisen" Pavilion, as they are as much as 60 per cent lighter than standard overhead travellers.

All the track wheels of the suspension cranes and crabs are equipped with ball bearings, and, as the flange friction, too, was reduced to a minimum by the pendulating suspension of the runways, the travelling friction resistances are very slight, so that loads up to two tons and cranes of not too wide a span can be travelled by one man simply by pushing or pulling the load. In view of the hot materials to be transported, the full casting ladles and the enormous crane spans, the cranes and crabs in the "Stahl und Eisen" Pavilion were provided with electric travelling drive (Fig. 5).

All movements can be controlled from the floor or from the driver's cab which is coupled to one of the crabs.

The erection of the entire plant with junction track and travelling crabs was a very simple matter, all connections just being clamped, so that there is no need to do any drilling or even rivetting on the site. The suspension crane plant was, therefore, erected in a very short time.

Electricity in Manchuria

(Continued from page 276)

The rates of the Manchurian electric companies, on the other hand, were extremely high, due to disorderly management and small distribution of electricity. This fact proved to be the main obstacle to the spread of electricity. However, with the establishment of the Manchuria Electric Corporation through the amalgamation of numerous firms, a gradual unification of rates on a rational basis was undertaken, taking into consideration the geographical condition and the state of demand in each district. It is stated that the unification of electric rates throughout Manchuria will be completed within five years.

Since the Manchurian Incident, there has been a marked increase in the amount of electricity generated, which, in 1935, totalled 1,084,000,000 kilowatt-hours, representing a twofold increase as compared with the 500,000,000 kilowatt-hours in 1930. At present 98 per cent of electricity in Manchoukuo is generated by caloric heat, the amount of coal consumed for this purpose running up as high as 1,000,000 tons a year. With the development of various industries in the future, the demand for electric power is bound to increase. To meet this increased demand by caloric power would mean the consumption of an enormous amount of coal annually, which would not be desirable even for a country such as Manchuria, which is blessed with almost inexhaustible coal deposits. The Government, therefore, is planning to harness the vast hydraulic resources of the country, which, it is estimated, are capable of producing constantly a supply of 1,500,000 kilowatt-hours of electricity. For this purpose it has, since 1935, been undertaking an exhaustive investigation of hydraulic resources under a ten-year plan. A plan for the development of hydro-electric industry under the State management is, in fact, already reported to have been decided in conjunction with the new five-year industrial development plan, which is being executed at a total expenditure of some two billion yen.

The electric industry of Manchoukuo, as the foregoing analysis shows, is yet in an undeveloped state, when it is considered that the percentage of electric consumers is only 5.9 per cent of the total population, while the number of people residing in the districts supplied with electricity is as low as 1.7 per cent of the entire nation. However, as the economic standard of the masses rises with the development of industry, the electric industry, under the efficient management of the Manchuria Electric Corporation, and the enlightened supervision of the Manchoukuo Government, should, in the near future, carry the "light of civilization" to the length and breadth of the Empire.

Viewing the Yellow River in 1937*

By O. J. TODD, Secretary of the Association of Chinese and American Engineers

THERE is no use being emotional about the Yellow River. Its control is a problem that requires intimate knowledge, based on close inspection of many details. And yet, with all details thus far assembled the best of our river engineers do not feel sure that they know just how to handle the problem most economically and efficiently. Floods come and go as did that of 1936 when the main dikes were breached and the inundated lands aggregated 6,000 square miles with property losses estimated at over $200,000,000 silver, and a population of about 5,000,000 was seriously affected. Then the following spring the river was put back into its old bed and remains there for the present. It may remain in that same bed for some years since considerable dike improvement work has been done in recent months. Yet every Yellow River engineer knows that the problem is not solved.

It is one thing to tackle a serious dike break along this river in the Great Plain of China and systematically close said breach by either of the two proven methods of performing this feat. Practice may be said to be rather well standardized in this respect and the present Yellow River Commission should be able to handle any major dike break and by the following spring have the breach entirely repaired and the river flowing in its old channel. That can occur for several more years, at least, with the present course of the river. Yet who shall say how many years it will be before silting of the bed will make maintenance of the present dike system so difficult that another course, parallel to it, may be more suitable ?

It is very possible that the dike system alone can hold all moderately heavy floods within the present river course for several years to come on account of the better patrol and repair work that seems possible with the newly strengthened and more authoritative Yellow River Commission with its centralized responsibility. A degree of vigilance may be expected in this respect comparable to that of the Mississippi River Commission which so ably handled the Ohio River floods of last spring. It is history now how well the routing of these floods from Cairo to the Gulf of Mexico was handled.

But as American engineers insist that detention reservoirs are needed on the feeders of the Ohio River in western Pennsylvania and eastern Ohio, so engineers who have closely studied the Yellow River floods wish to have this same feature of flood control studied for this troublesome river of China. Despite the heavy mud load it is thought that detention basins may be arranged so that the highest crest floods may be ironed out and thus detained a few hours to relieve the flood situation through the Great Plain, particularly for the first 200 miles east of the Peiping-Hankow Railway bridge. To the river student the investigation of suitable reservoir sites both on the main river in Honan and the Shensi-Shansi border seems very necessary. Also similar studies along several of the main feeders is of almost equal importance. When we consider that in early July, 1935, the Lo Ho of Honan contributed 250,000 sec.-ft. to the flow in the main river just above the beginning of the Great Plain it is realized that here is a problem in detention of crest flows in order to prevent the synchronization of this feeder's discharge with a major flood coming down the main river.

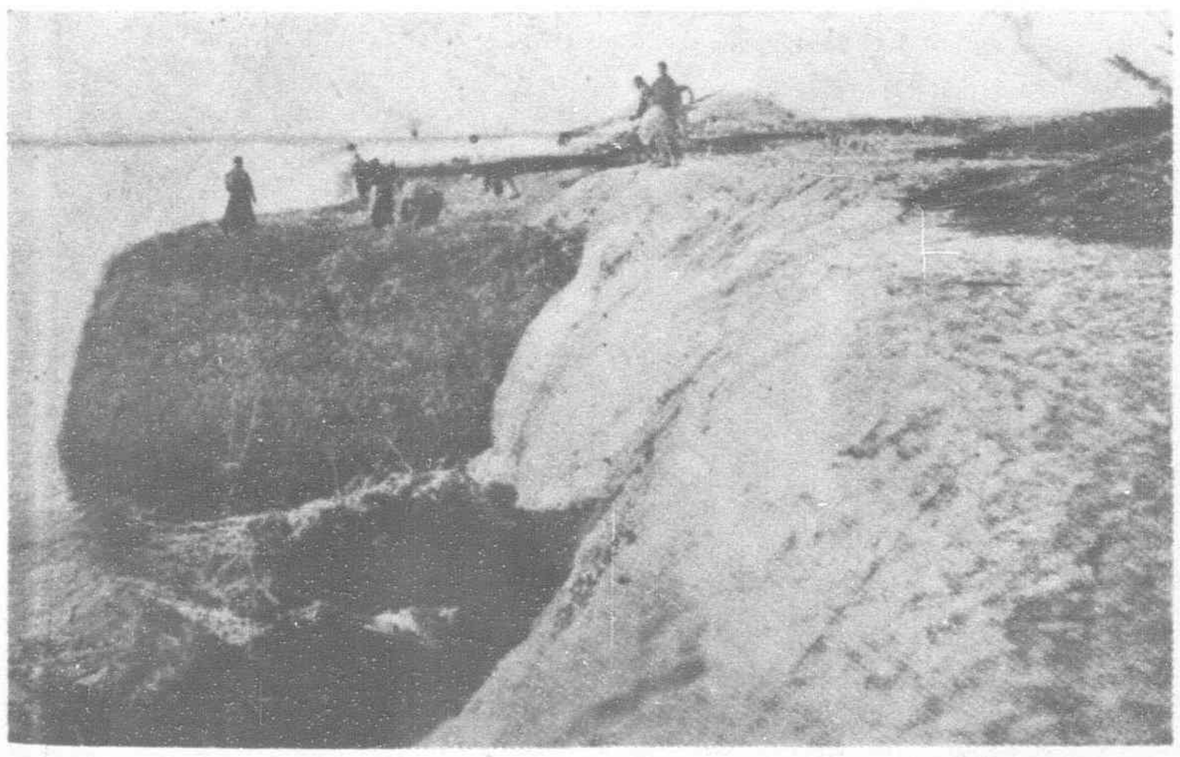
Then other specialists tell us that neither the diking program nor this aided by the detention basin scheme will prevent future great floods from this river which carries such a heavy mud load. These men state that we must go to the source of the trouble and put a stop to soil erosion in the hills of Kansu, Shensi, Shansi and north-west Honan. The engineer feels this is more easily said than done, yet we all know that an adequate program for the control of soil erosion would go a very long way toward solving this whole problem. It is the heavy silt load in the Yellow River that causes such difficulties when it is sought to route the flood waters across the Great Plain to the sea.

Already the Yellow River Commission has put an able forestry graduate at work on this angle of the problem. At the town of Linpao in western Honan on the south bank of the Yellow River a field laboratory has been set up to experiment in various methods of soil-erosion control. Many of the printed pamphlets on the subject from the American Government, the University of Wisconsin, University of California, etc., have been studied by this man and his engineering colleagues. Here, in China, the emphasis is not so much on the loss of farming land through erosion as the damage to the main river and to lands where sand deposits cover good farming lands on the plains. It is not true that all the solid matter that comes down the Yellow River is good as a fertilizing agent to replenish worn-out lands. The very fine silt from the loess deposits and the clay is good for the lands on the plains, but sands also come down the river that destroy lands for farming when they are deposited on them in quantity as was the case in 1935, in western Shantung, over an area of about 300 square miles.

The depletion of good farm lands by constant erosion means making eastern Kansu, Shensi, Shansi, and parts of Honan constantly less productive as agricultural regions. Since the greater part of this is borne out to sea it is wasted to a great extent. American soil students say that the upper seven to eight inches of our farm lands contain the best soil for agriculture. If this is used to make deep fills at the sea coast in the Gulf of Chihli it is mostly lost for growing food.

We may, therefore, view the situation in 1937 as one that should cause deep alarm since many, many millions of people depend on the agricultural stability of the Yellow River Valley, including the Great Plain, for their very existence. As engineers

* *Journal of the Association of Chinese and American Engineers.*



In Shantung the earth banks of the Yellow River are sometimes protected by large groins of kaoliang stalks

Hu-K'ou falls at flood time showing site of possible dam for temporary detention of floods and for hydro-electric development

At flood times in western Shantung when dykes are cut by swift currents of the Yellow River, willow trees are thrown in and tied to the banks by hemp ropes as temporary retards

These loess hills of central Shensi are being eroded rapidly and are causing excessive mud loads for the Yellow River to carry seaward

we must recognize that there are three major angles to the problem—dike maintenance through the Great Plain, detention basins on the main river and its tributaries west of the Plain, and the control of soil erosion. The first two are urgent and can be handled in our day. The last-named task will take decades but should be begun now.

Other helps to flood control include settling basins in western Shantung to temporarily take care of extreme floods that cannot be thoroughly arrested by the detention basins, a by-pass system comparable to that of the Atchafalaya along the lower Mississippi, and a refertilization plan that will take the upper parts of mud-charged flood waters and put them over zoned areas in rotation, thus both reviving overtilled lands and helping relieve the main river channel of heavy discharge flows. An irrigation scheme may also prove to be practicable. This would take off to the west of the Peiping-Hankow Railway and irrigate a strip of land north of the river. It would have a small effect in reducing flood heights, though at flood time it might not be advisable to take water into irrigation ditches due to the heavy mud load.

As one of the by-products of this river's flow we must consider hydro-electric development. There is an opportunity to do something by taking the ordinary flow of the river at Hu-k'ou Falls on the Shensi-Shansi border and converting this into power that may be used in south-western Shansi for pumping water to irrigate high-lying plateau lands. Also part of the power may be used for industrial purposes at Tungkwan and Sianfu.

The river has uses that have not yet been developed and these three, power, fertilization and irrigation, are all worthy of closer study than has been given them in the past. In an article entitled "Shansi Water and Power Problems," published in the *Journal of the Association of Chinese cnd American Engineers* for July-August, 1935, the writer spoke of studies he had already made in connection with this problem of Yellow River power. The matters of refertilization and of irrigation, as suggested here, have not been heretofore covered in technical papers as far as we know. No surveys and careful studies of those problems seem to have been made as yet. They suggest possibilities, however.

Without discussing detail of technique, we now find that a study of data available to date, brings us to the conclusion that the regulation of the Yellow River on a comprehensive basis will entail under the head of control the following:

(1) More careful protection and improvement of the dike system and the main channel from the Peiping-Hankow Railway to the sea.

(2) Construction of some system of detention and settling basins on the main river, on the main tributaries and in western Shantung, by the side of the main river on the plain.

(3) Soil-erosion control on a broad basis.

(4) Possibly a by-pass system or auxiliary channel similar to that provided for the Mississippi River by the Atchafalaya.

Under river conservancy we may list the following:

(1) Hydro-electric development at Hu-k'ou Falls.

(2) Refertilization by skimming off mud-charged flood crests through gate structures, and handling this flooding of farm lands in rotation by a zoning system.

(3) Construction of an irrigation system, taking from the main river on the north bank between the mouth of the Ch'in Ho and the Peiping-Hankow Railway.

This is a brief outline of possible enterprises that might contribute to the solution of the Yellow River problem. When one looks at this problem from a number of angles, and realizes the potency of this great river system for good or evil, or both, its complexity becomes real and its solution or the attempts at solving it become most fascinating. Whether at its extreme low-water flow of 6,000 sec.-ft. or its possible maximum flow of 1,000,000 sec.-ft. this river always is baffling man, because it scours and fills and carries away a load that is staggering, as high as 50 per cent by weight in solids at times. Our American Missouri and Mississippi and Colorado rivers may be the nearest to it for use in comparison in studying the silt problem, but the Yellow River stands, after all, in a class by itself and is as elusive as the wicked flea.

PHILIPPINE GOLD PRODUCTION INCREASING

(Continued from page 284)

before they are allowed to escape to the river below. The concentration is carried on in shallow, oblong depressions in the hillside, about one meter long by 0.5 meter wide into which a tiny stream of water is delivered until all the gauge has been washed out, leaving only rich sulphides. She keeps the latter in a basket for further treatment at home.

"The depressions which serve as concentrators are located on the hillside, one above the other, the one below taking the tailings from the one above and so on. The tailings are concentrated at least six times before they are turned into the river so that the actual residual gold content is then very small.

"The rich ore and the concentrates are taken home and there ground in a native mill, then panned in a bark pan, smelted, and finally sold. The crusher is a large, flat stone, usually of diorite, about 0.5 to 1.5 meters long, with a depression hollowed out in the center. After being broken by hammering between two stones, the ore is placed in this hollow and is crushed down so fine that it would pass a sieve having 40 meshes per centimeter (100 meshes per inch). The muller or rubstone, weighs 15 to 20 kilograms and is usually of the same hard stone as the bottom.

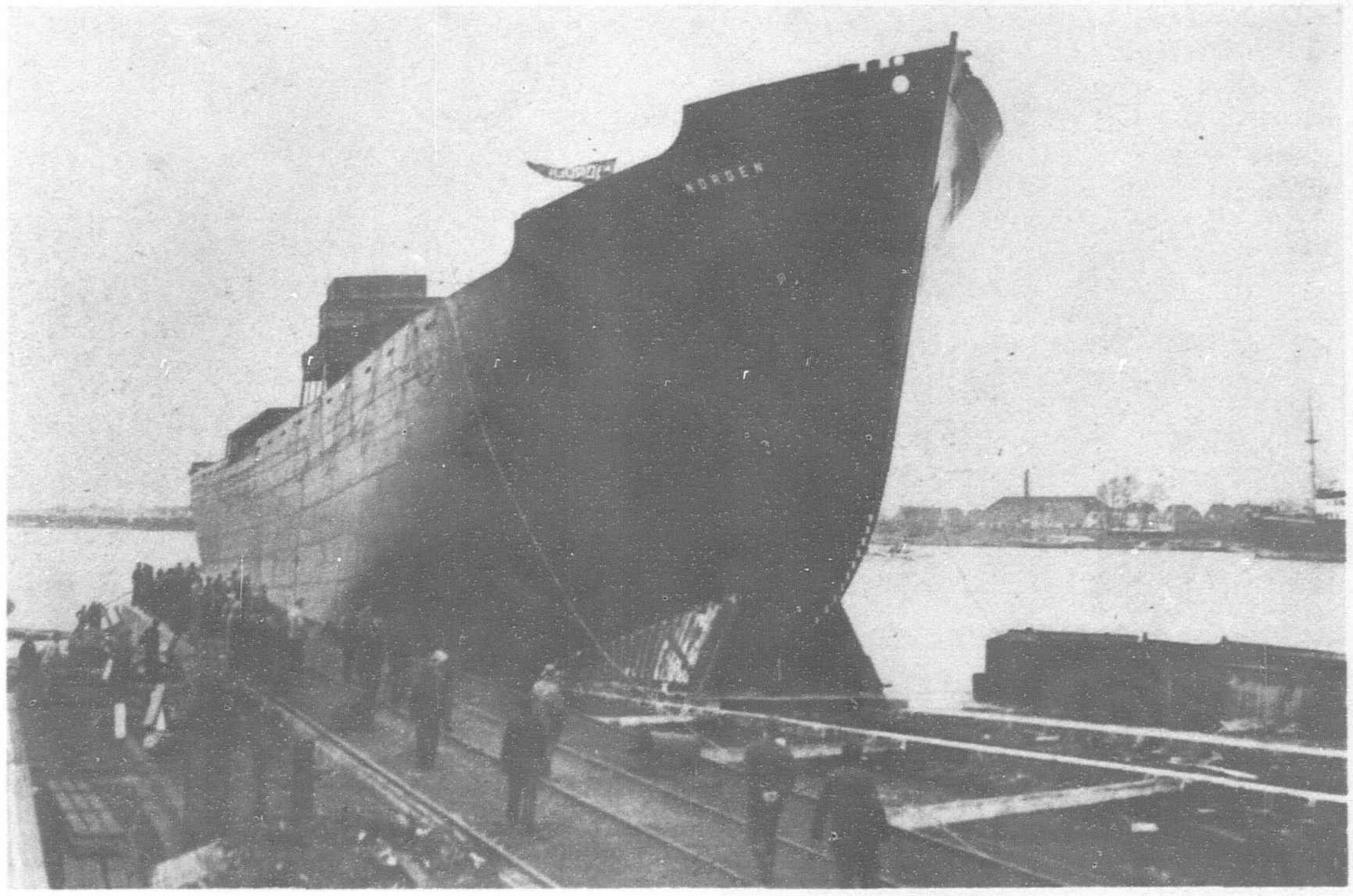
"The ore is always well mixed with water, and the rubbing is a direct pushing and pressing such as is used in washing clothes on a washboard. The fine ore is collected in an earthen pot and is then panned."

An Enterprising Firm of Danish Shipbuilders

The Nakskov Shipyard

ONE of the most important builders of up-to-date vessels designed for the Far Eastern Trade is the Nakskov Skibsvaerft whose shipyard is situated at the port of Nakskov, Denmark, which lies at the entrance to the Baltic and just opposite the entrance to the North Sea Canal.

It may be mentioned, as a matter of historical interest, that in 1630 the Danish King Christian IV founded a shipyard at the port of Nakskov, and having engaged a Scotch shipbuilder by the name of Daniel Sinclair, constructed a great number of ships for the Danish Navy, which was a fleet to be reckoned with in those days. Many ships have since that time left the slipway at Nakskov.



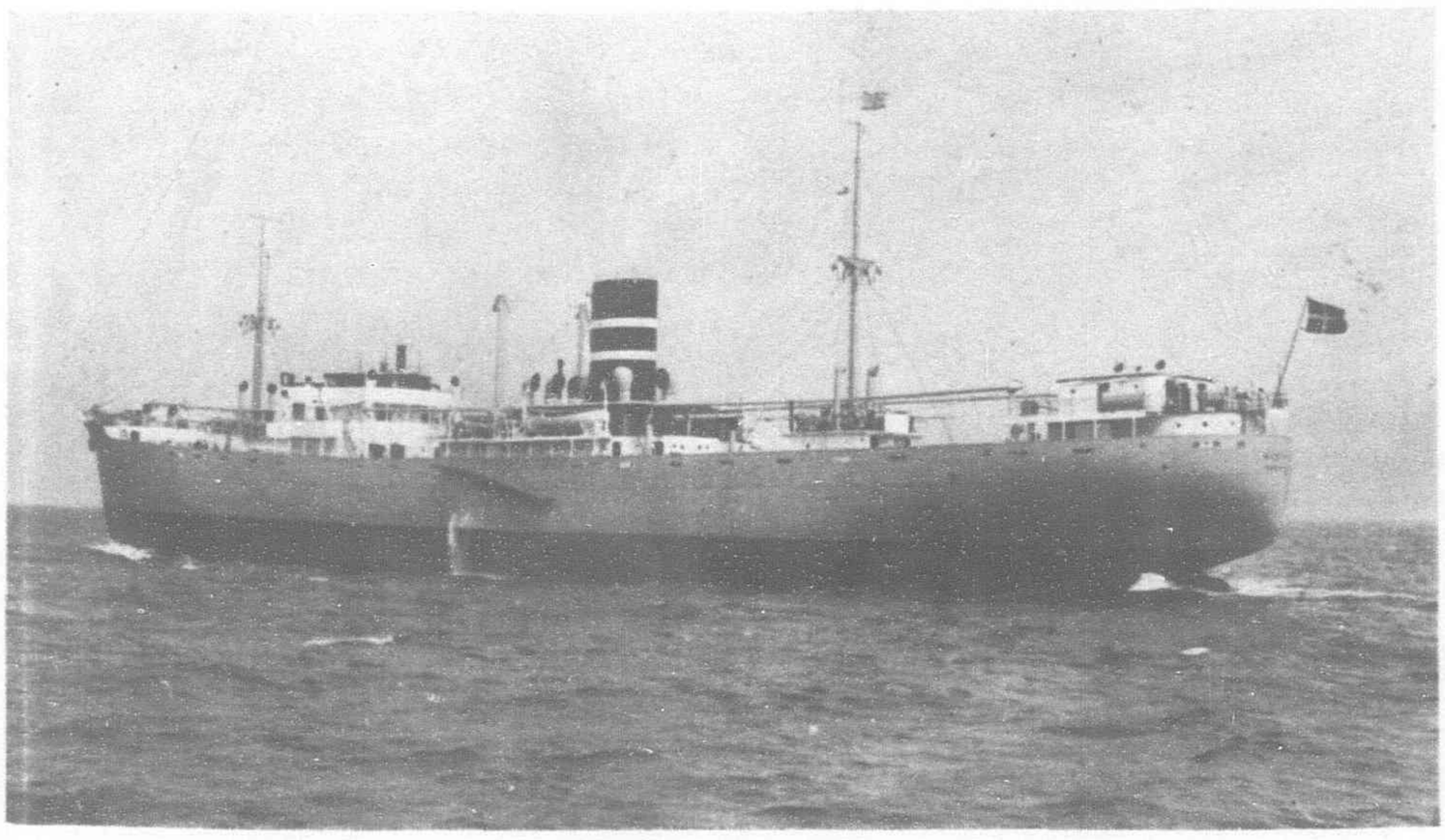
The motorship " Norden," built by the Nakskov Skibsvaert to the order of Messrs. The Norden Steamship Company, Ltd., of Copenhagen, going down the slipway at Nakskov

In 1916 the Nakskov Skibsvaerft was established for the construction of modern vessels and the yard was built during the next two years. In 1919 the first ship, the Diesel tanker *Mexico*, was launched and since then many ships of every size and description have been floated. In addition to the construction of new vessels, a large number of boats have been repaired by the company.

Within the last decade the Nakskov Skibsvaerft has built, to the order of Messrs. The East Asiatic Company, Ltd., many large passenger motorships for their regular trade between the Far East and Europe. These ships have proved very successful and on account of the high standard of accommodation provided by the owners they are very popular with the travelling public on the eastern routes.

The company has lately been awarded an order from Messrs. The Norden Steamship Company, Ltd., of Copenhagen, for a new twin-screw motorship. The trial trip of this boat, called the *Norden* took place on Saturday, May 22, 1937, and a description of its principal characteristics is given in the following. The dimensions of the ship are :

Length overall	430-ft. 0-in.
Length between perpendiculars	400-ft. 0-in.
Breadth moulded	57-ft. 0-in.
Depth to main deck	27-ft. 6-in.
Carrying capacity	8,380 tons D.W.



Full view of the motorship " Norden " when on trial run

and the ship is built to Lloyd's highest class with open shelterdeck with forecastle and with deckhouses amidships and aft. The double bottom, extending the whole length of the ship, is arranged for fuel oil.

The ship is furnished with two masts and two derrick posts, 11 derricks, one of which for 20 tons and 10 with a lifting capacity of five tons, which are served by ten five ton electric cargo winches from Messrs. Thomas B. Thrige, Odense, Denmark. Further there are likewise manufactured by the same firm, electric driven windlass, warping winch and electric steering gear.

In the saloon-house there are, besides a large beautifully equipped saloon, arranged light and comfortable two-berth cabins for passengers, with adjoining toilet—and bathrooms, as well as cabins for mates and chief steward and pantry.

The captain's house, situated on the lower bridge, and in which the captain's living room and cabin with adjoining toilet-room are arranged, further contains two passenger cabins. On the navigating bridge the charthouse and the radio station with radio direction finder are located.

In the engine-house there are cabins for engineers, assistants, the restaurant staff and boys, as well as the officers' mess-rooms and galley with baking oven arranged for oil-firing.

The crew's cabins, each for two men, are arranged in a deck-house aft, whilst mess-rooms for deck—and engine-crew together with two cabins for carpenter and boatswain are to be found in separate house aft above the crew's accommodation house. All living rooms for officers and crew are light, roomy and comfortably equipped and well ventilated. In cabins, toiletrooms and bathrooms, hot and cold water is provided.

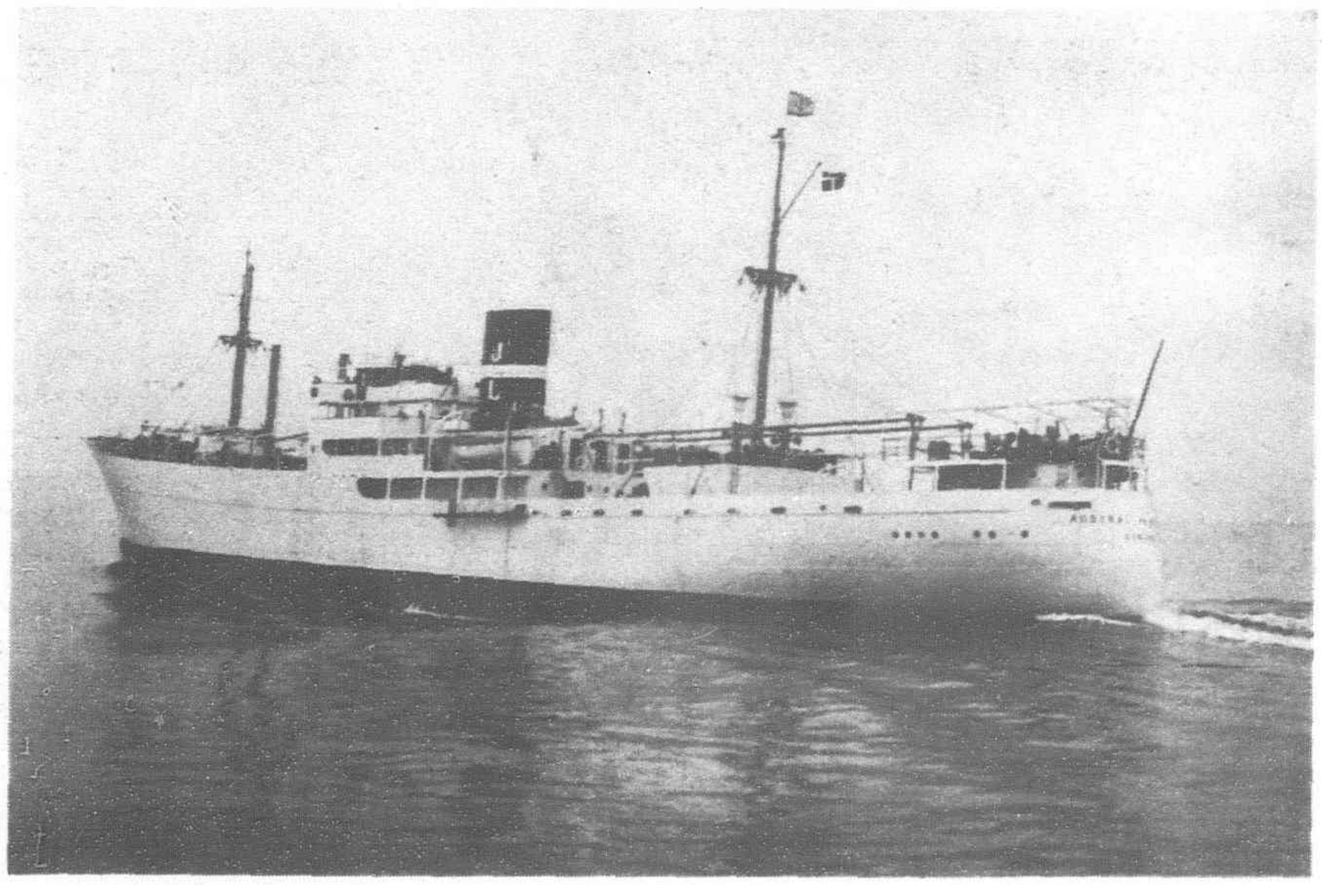
For the ship's provisions a large cooling chamber is provided, the refrigerating machinery of which has been supplied by Messrs. Thomas Ths. Sabroe & Co. of Aarhus, Denmark.

The propelling machinery consists of two six-cylinder Burmeister & Wain two-stroke cycle, single-acting Diesel motors totalling 4,300 i.h.p., which give the loaded ship a speed of about 14 knots. For heating the ship a boiler is provided, which is so arranged that, at sea, it is heated by the exhaust gas of the motors, whilst in port it is heated by oil-firing. The same boiler is used for heating about 1,000 meters of heating coils fitted in the deep-tanks of the ship, which are arranged for transport of vegetable and mineral oil, and, of course, also of other cargoes. All cargo holds of the

ship are furnished with CO_2 fire extinguishing devices.

After the trial trip successfully displayed all the ship's advantages, it at once departed on her maiden voyage to Japan via Copenhagen.

Ships for special services, such as cable steamers, railway and motor-car ferries, have also had the attention of this enterprising shipbuilding concern. In addition to motor passenger boats the company has recently constructed a new fruit carrying motorship, the m.s. *Australian Reefer* for the company Messrs. J. Lauritzen of Copenhagen. The trial trip of the *Australian Reefer* was successfully carried out on Tuesday, March 23, 1937.



The fruit motor ship "Australian Reefer" attained a speed of 17 knots on the trial trip

This ship is built for the fruit trade, and the speed, which has been taken into consideration in the construction of the form of the ship is of particular importance.

The principal dimensions are:

Length between perpendiculars		330-ft. 0-in.
Breadth moulded		47-ft. 6-in.
Depth to upper deck		27-ft. 6-in.
Net bin capacity	about	187,000 cbft.

The *Australian Reefer* is built with two complete decks and long forecastle as a cargo motorship with cruiser stern and is constructed to Germanischer Lloyd's highest class. Deck houses, boat deck and navigating bridge are arranged amidships. She has a double bottom extending the whole length of the ship, divided into 13 compartments.

The ship is equipped as a modern fruit boat, with cargo cooling arrangement for carrying fruit and meat in cooled condition, with ammonia compressors with direct evaporation, manufactured by Atlas, Copenhagen. The compressors are driven by T.B. Thrige electromotors. The auxiliary motors drive dynamos which generate current for the electrically driven auxiliary machinery. Air in the cooled cargo holds is circulated by electrically driven fans.

For freight purposes the ship is equipped with two masts, four derrickposts and five hatches, which are served by 10 electric cargo winches for three tons, and further a warping winch is placed aft and a windlass afore, both electrical.

The steering is carried out by means of an electrically driven steering gear placed below upper deck aft. The rudder is a double-plate rudder, and in choosing the form of the stern the latest experiences as to the influence of the streamlines on the speed of the ship have been taken into consideration.

The ship is furnished with radio apparatus, radio direction finder, echo sounding apparatus and electric log. There are four large, well equipped passenger cabins with adjoining bathroom and W.C., and the saloon of the ship is tastefully carried out in mat polished birch.

The officers' cabins and mess-room are arranged amidships and are in every respect comfortable, light and airy and have furniture made of mahogany and oak; special care has been taken that the cabins are well ventilated, electric heating is provided. For the officers' use two bathrooms with cold and warm fresh water are installed.

Radio station and the captain's cabins are placed in a house on the promenade deck, and in front of this is a large and closed verandah for the passengers. On the navigating bridge is a pilot house with chartroom in front.

The crew's cabins are arranged aft below the upper deck. They are large light rooms, arranged for two men in each cabin. The furniture in these rooms, which comprises wardrobe for each man, tables and sofas, is of oak, and curtains are provided for side-lights and berths. Likewise in these cabins care has been taken that there is ample ventilation and good electric lighting and heating. Mess-rooms for deck—and engine-crew and W.C.'s and bathrooms are arranged in a deckhouse aft with stairway to the accommodation below the deck. The mess-rooms have oaken furniture and curtains. Further, there is installed radio in the sailors' mess-room for the crew's use, and a library is found on board for the crew.

The propelling machinery consists of one 10-cylinder Diesel motor of Burmeister & Wain's two-stroke cycle, single-acting trunk type with solid injection, developing 4.300 i.h.p., which gives the ship a speed of about 15½ knots.

The ship has bronze propeller and electric light everywhere as well for all living-rooms as for loading and discharging. On the trial trip a speed of 17 knots was attained.

HUGE AQUEDUCT IN OSAKA-KOBE DISTRICT

THE Hanshin Municipal Aqueduct Association has formally approached the Osaka forestry office for permission to make a land survey for the construction of a huge aqueduct in the state-owned forest in the Osaka-Kobe district.

According to the plan of the association submitted to the forestry authorities, the construction will cost Y.22,250,000. The association has also taken steps to ask permission of the Finance Office to raise the necessary fund by a debenture issue to the amount of Y.3,000,000 a year.

Following the completion of the first-stage project in 1942, the aqueduct will be able to furnish an ample water supply for 500,000 people in the cities, towns, and villages in the Hanshin district, says the prospectus of the aqueduct association.

The second and last stage of the project will be completed in 1950 when the establishment will be able to supply water to 1,000,000 persons. The projected work will thus save Kobe and its neighborhood from the customary shortage of drinking water in the summer months.

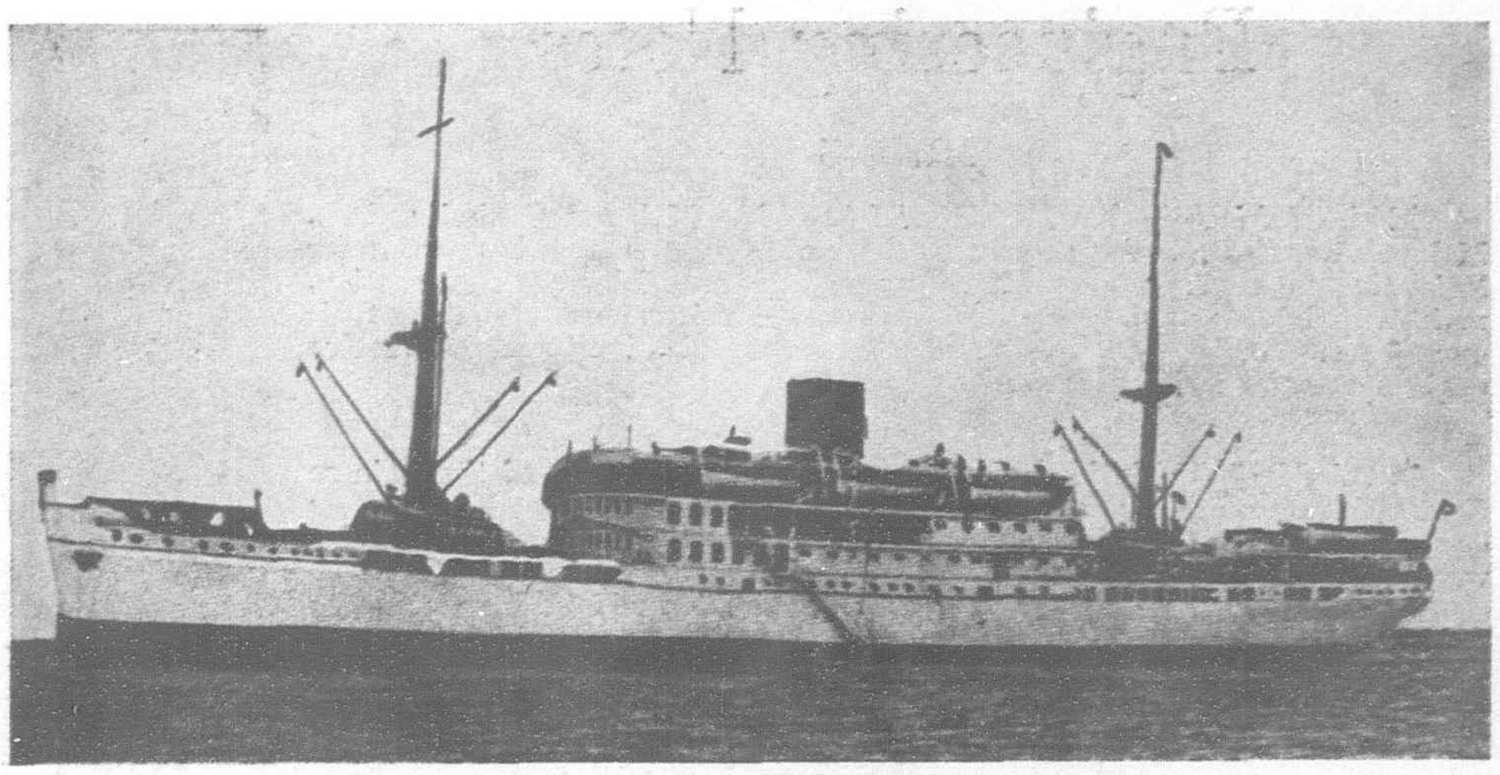
The aqueduct will be fed, according to the association's plan, by the present Chikari reservoir of the Kobe municipal waterworks and also by a new reservoir to be constructed near the confluence of the Kurokawa and Kiyonogawa, the two tributaries of the Mukogawa.

The projected basin will have a maximum depth of some 90 feet and will be about 36 kilometers in circumference. It will have a capacity of 420,000,000 cubic feet, according to the plan.

As a precaution against any possible drying-up of the Mukogawa reservoir, the water will be conducted into the projected aqueduct at a point about 630 meters up the Nagarabashi, a bridge spanning the Yodogawa in Osaka. The water will then reach the Kabutoyama filter bed via the pumping station at Kita Kawaguchi-machi, Higashi Yodogawa-ku, Osaka.

The projected territory of the new water service includes: the city of Amagasaki; Soneda-mura and Tachibana-mura, two villages in Kawabegun of Hyogo prefecture; Ojo-mura, Muko-mura, Kawaragi-mura, Naruo-mura, Koto-mura, Sumiyoshi-mura, Motoyama-mura, Honjo-mura, and Seido-mura in Muko-gun; the towns of Mikage and Uozaki, in the same district; and the cities of Kobe and Nishinomiya.

New K.P.M. Motorship on Run from Saigon to New Zealand



The new K.P.M. Motorship "Maetsuycker"

On March 4, 1937, the new motorship, *Maetsuycker*, arrived at Tandjong Priok. This vessel was built by the Nederlandsche Dok Maatschappij for the K.P.M. (Koninklijke Paketvaart Maatschappij), and on January 23, last, after a successful trial run, was taken over by the K.P.M. Designed by the Technical Department of the K.P.M., the *Maetsuycker* was constructed under the direct supervision of the Bureau Veritas and was passed out into the highest class both as regards the ship itself and in respect of the engines and machinery. The vessel satisfies the most exacting requirements of the shipping inspection authorities, all demands of the Netherlands Indian Shipping Inspection Service, and needless to say, those of the International Marine Safety Convention of London, 1929, and of the International Convention respecting Loadlines of July, 1930. This may certainly be regarded as a guarantee of safety, both for passengers and for the crew. For additional safety and comfort, the K.P.M. have furnished the vessel with the most up-to-date equipment so that it can be said the M.V. *Maetsuycker* is the most modern ship plying in East-Indian and Australian waters.

The main engine, a product of the well-known Werkspoor factory, is the latest type of a single acting 4-cycle engine, with supercharger and without compressor. The three auxiliary Stork-Hesselmann motors, each driving a dynamo of 160 kw. were constructed by the Machine Factory Stork at Hengelo, Holland. In addition there is a central emergency station which supplies power by means of a Kromhout-Gardner motor driving a dynamo of 30 kw.

The ship offers accommodation to 24 first class A and 30 first class B passengers.

The vessel is destined for the new K.P.M. line from Saigon, via Singapore, Java, Noumea, and Australia, to New Zealand—the so-called South Pacific Line—and we feel certain that passengers who will have sailed this exceedingly long voyage through tropical seas on this ship, will ever look back with pleasant recollections upon their voyage as having been one continuous delight. Modern arrangements for the ventilation of the cabins and saloons, by means of the punkah-louvre system, have been installed in such a manner that in cooler regions the air can be warmed and given the proper degree of humidity. All parts of the ship are connected with an automatic fire alarm arrangement, according to the Lux-Rich system, placed on the navigating bridge. This instrument immediately warns the officers on watch if there is any sign of a fire or even smoke in any part of the ship. A new alarm signal installation which operates bells and claxons has been arranged so that the passengers and crew will receive warning direct from the bridge.

The very powerful radio installation of the vessel also includes a radio direction-finder.

The ship is also supplied with the so-called Echo Sounding apparatus which registers the ultra-sonorous vibrations reflected from the sea bottom, these vibrations having been first sent out by the apparatus, so that in this way the depth of the water can immediately be correctly determined.

The sloop davits are equipped with electrical winches, so that within a minimum of time the life-boats can be lowered to the level of the water.

A modern laundry has been installed, an accommodation which will be greatly appreciated by passengers on a long voyage.

The passengers' cabins are luxuriously equipped, and all have a constant supply of hot and cold running water. The saloons have been decorated in a dignified style, but without excessive luxury, and are exceedingly comfortably furnished, the ventilation system providing an agreeable temperature in any climate.

Apart from the great consideration which has been given to the accommodation for passengers, the utmost care has been given to the means for transporting horses on the long voyage from Australia to the East Indies or Siam. There is room for at least 100 horses in stables of the most modern type and construction.

The vessel has been specially equipped with refrigerating and freezing holds for cargo. The engine installation for this purpose (liquid ammonia compression system) has been constructed by the Apeldoorn Machine Factory. This installation operates by means of an automatic temperature regulator, and particularly in the case of fruit transportation the cooling holds can be given a supply of circulating air which not only is kept exactly at one desired temperature, but also can be given the precise degree of moisture required for each kind of fruit.

Every detail of the M.V. *Maetsuycker* has been studied with exceptional care and she may certainly be regarded as a most welcome addition to the K.P.M. fleet.

The principal measurements of the *Maetsuycker* are as follows :—

Length overall	114.45 m.—375-ft. 6-in.
Length between perpendiculars	109.05 m.—357-ft. 9½-in.
Beam, moulded	15.95 m.— 52-ft. 4-in.
Depth, moulded, to upper deck	7.98 m.— 26-ft. 2-in.
Height of promenade deck	2.41 m.— 7-ft. 11-in.
Draft, loaded	6.1 m.— 20-ft.
Tonnage, gross	4,119.52 tons
Tonnage, nett	2,426.51 tons
Speed	15 knots
Engine output	3,600 shaft h.p.

—*Java Gazette.*

ALUMINIUM ELECTROPLATING

Climaxing 21 years of extensive research work, Mr. Zenji Sugahara, 53, instructor of the Osaka Municipal Polytechnic School, recently invented a new aluminium electroplating process similar in a way to the now popular alumite process.

According to the inventor, the new process requires only one-sixth the time and one-fifth the cost of the latter process, and his products are far more durable than alumite. An alloy of cadmium and nickel is used for the new electroplating process.

Resolved to find a substitute for aluminium, which Japan must import wholly from abroad, Mr. Sugahara commenced his research work in 1916. In the course of 21 years, he has obtained three patents for his inventions. Patent rights for the new process were granted by the Japanese government several months ago.

It is expected that the new invention can be used to advantage in the manufacture of airplane materials and spinning machinery.

Engineering Notes

MINING

MALAYAN COLLIERIES EXTENSIONS.—Malayan Collieries, Ltd., Malaya's largest coal mine operators, of Batu Arang, Selangor, have asked for legislative powers from the F.M.S. Government authorizing the construction, maintenance and working of private railway extensions for transporting their own goods. A Bill has been drafted to give authorization to use locomotive engines and run trains over the new railway.

NEW COAL MINING.—Having acquired the property of the Chinese Great Wall Coal Mining Co., the Japanese Oriental Development Co. is now organizing a joint Sino-Japanese concern for the exploitation of the Chinwangtao coal deposits, estimated at 50,000,000 tons.

Upon organization in May, the new firm, which will be known as the Oriental Development Coal Mining and Railway Co., proposes to have an output of 300,000 tons of coal a year, according to Oriental Development Co. officials. This will be raised, four years later, to 500,000 tons annually.

RAILWAYS

NEW RAILWAY IN THE U.S.S.R.—During 1936, seventy million roubles was spent on the construction of the Uralsk Iletzk railway, at present being built in Russia. It will connect the Ryazan-Ural railway with the Orenberg line, and will provide the shortest route between the Ukraine, North Caucasus, Central Asia, and Siberia across the Saratov bridge.

INDIAN RAILWAYS IN 1935-36.—According to the annual report of the Indian Railway Board for the year ended March 31, 1936, there were 43,118 route miles open, of which the State owned 31,783 miles. During the year, 111 miles of new lines were opened, and at its close 63 miles were under construction. The total earnings of all railways in the country were £78,000,000, of which £48,750,000 was from goods traffic, £23,250,000 from passenger traffic, and £6,000,000 from other sources.

RAIL SLEEPERS.—An order for 80,000 railway sleepers has been placed with lumber merchants in Kiangsi, by the Chekiang-Kiangsi Railway Administration, in connection with the construction of the Nanchang-Pingsiang section of the railway. It is learnt that 100,000 sleepers for the Nanking-Kiangsi Railway have already been supplied by the Kiangsi merchants.

INDUSTRIAL

NEW COTTON MILL.—The provincial authorities at Kunming, Yunnan, are organizing a cotton mill with a capital of $800,000. They hope to put the plant into operation in the near future. This, it is hoped, will reduce the large amount of cotton goods imported into Yunnan.

NANKING SEWAGE.—The Municipality of Nanking is launching a $6,000,000 project to construct a much-needed drainage and sewage disposal system in the capital. This piece of construction, to be completed in three years, is under the direct supervision of Mr. H. S. Sung, director of the Public Works Department. Mr. F. J. M. Alma serves as chief engineer of the project.

NICKEL PLANT.—Japan's first nickel-producing company, the Japan Nickel Company, is to be capitalized at Y.5,000,000 and begin construction of its plant at Miha village, Tano-gun, Gumma Prefecture, where it will buy a mine said to contain 30,000,000 metric tons of ore, containing .33 of one per cent of nickel. Production is estimated at 350 to 400 metric tons annually. Japan's requirement averages 3,000 metric tons a year, worth about Y.10,000,000.

BIG FOREST STATION.—Under the sponsorship of Mr. Ma Chun-wu, President of the National Kwangsi University, a ten-mow forest station will be shortly opened at Liuchow, a famous lumber producing center in South China, for the plantation of tung trees. Some 30,000,000 tung trees will be planted with improved methods on the projected fields. They are expected to produce 900,000 catties of wood oil, valued at $300,000 to $400,000 annually. The station is to be operated by the San Tze Company.

JAPAN PLANS SYNTHETIC OIL.—Plans for the manufacture of 2,000,000 metric tons of synthetic oil on a seven-year program, by a Japanese semi-Government company, with a capital of Y.100,000,000 have been adopted. The Government will invest Y.50,000,000 in three years. The initial payment, Y.12,500,000, has been included in the next budget of the Commerce and Industry Ministry. The general outline of the plan calls for oil production at the end of the seventh year, when the output will be 2,000,000 metric tons, of which 1,000,000 metric tons will be gasoline and the remainder heavy oil. To protect the company, the Government will introduce a license system for the manufacture of synthetic oil. A subsidy will be granted, as the enterprise is not expected to prosper normally. A Bill authorizing the company and another for the protection of the industry will be submitted to the next Diet.